No. 15742

IN THE

United States Court of Appeals

FOR THE NINTH CIRCUIT

ELECTROFILM, INC.,

Appellant,

vs.

EVERLUBE CORPORATION OF AMERICA, A. R. BOOKER, and K. TAYLOR,

Appellees.

APPELLEES' BRIEF.

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TOPICAL INDEX

TABLE OF AUTHORITIES CITED

CASES PAGE

ENCYCLOPEDIA

STATUTES

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APPELLEES' BRIEF.

I.
INTRODUCTION.

The appellees' brief in the above entitled action is not limited to an answer to Appellant's Opening Brief on file herein, but also includes a review of additional facts and arguments raised by appellees below concerning the validity of the patent in suit.

For brevity the exhibits of plaintiff and the cross-defendants are referred to as "PX" followed by the number of the exhibit (*e.g.,* "PX-1"), and the exhibits of defendant-cross-complainant are referred to as "DX" followed by the designating letter (*e.g.,* "DX-A"). All emphasis is ours unless otherwise noted.

II.
STATEMENT OF PLEADINGS AND FACTS DISCLOSING JURISDICTION.

The complaint in this case for declaratory judgment of invalidity and noninfringement of letters patent No. 2,703,768, owned by Electrofilm, Inc., asserted jurisdiction under the Patent Laws of the United States and under the declaratory judgment section, 2201 of Title 28, United States Code [Complaint, Para. IV, R. 4], in view of an actual controversy between EverLube Corporation of America and Electrofilm, Inc., as to the validity and infringement of said letters patent [Complaint, Para. VII, R. 4-5] which resulted from a charge of infringement made by Electrofilm to EverLube [Finding No. 5, R. 90].

The answer of Electrofilm contained a counterclaim for patent infringement designated as a "cross-claim", asserting jurisdiction under the Patent Laws [Cross-complaint, Para. V, R. 18; R. 17-22], and Electrofilm also filed a separate "Cross-claim for Patent Infringement and Unfair Competition" against the individuals A. R. Booker and K. Taylor [R. 32-39]. The Court found that this latter cross-claim also arose under the Patent Laws of the United States [Finding No. 5, R. 90], the unfair competition allegations of this pleading having been stricken on motion [R. 39-40].

III.
STATEMENT OF THE CASE.

(a) The Parties.

The plaintiff is EverLube Corporation of America, a California corporation [Finding No. 1, R. 89]. The defendant is Electrofilm, Inc., a California corporation, the owner of the patent in suit [Finding No. 2, R. 89; Finding No. 6, R. 90]. On the cross-claim of defendant, Electrofilm, for patent infringement, the cross-defendants

are plaintiff, EverLube Corporation of America, and two individual officers thereof, A. R. Booker and K. Taylor [Findings Nos. 3 and 4, R. 90].

Appellant, Electrofilm, Inc., the defendant and cross-complainant below, is referred to as "defendant" or "Electrofilm" herein, and plaintiff-appellee EverLube Corporation of America, as well as the individual cross-defendants-appellees, will be referred to collectively as "plaintiff" or "EverLube".

(b) The Issues.

All seven claims of the Hall patent in suit were in issue and held invalid below on the following grounds alleged in the complaint, which grounds are contested here by defendant:

1. Prior knowledge or use by others in this country before the alleged invention by the patentee, under 35 U.S.C., Section 102(a) [Finding No. 8, R. 91] and particularly by Acheson Colloids Company [Finding No. 9, R. 91], Bell Telephone Laboratories, Inc., Robert Burns, and Wilfred E. Campbell [Finding No. 10, R. 91-92].

2. Public use in this country more than one year prior to the earliest filing date of the application for the patent in suit, under 35 U.S.C., Section 102(b) [Finding No. 11, R. 92], and particularly by Western Electric Co., Inc., Chicago, Illinois [Findings Nos. 12 and 13, R. 92-93].

3. Prior inventorship, under 35 U.S.C., Section 102 (g), in that, before the alleged invention by the patentee of the process of the patent in suit, the said invention was made by another, namely Robert Burns of Bell Telephone Laboratories, Inc., which prior invention was never abandoned [Finding No. 14, R. 93].

4. The Court below also found lack of invention over the processes known or used, in prior public use, or pre-

viously invented, as set forth under Findings Nos. 9, 10, 12, 13, and 14 [Finding No. 14, R. 93]. It does not appear that defendant specifically contests in its brief this portion of Finding No. 15 by the Trial Court, which states [R. 93]:

> ". . . there is no invention disclosed or claimed in the Hall patent in suit over such prior knowledge and use, public use, or invention."

In addition to these four grounds of invalidity, plaintiff urged in its pleadings and throughout the trial below the following defenses:

5. Anticipation by prior art patents and publications, under 35 U.S.C., Section 102(a), in that the invention was patented and described in certain printed publications of others here and abroad before the alleged invention thereof by applicant.

6. Lack of invention over the prior art patents and publications, under 35 U.S.C., Section 103.

On both of these grounds of invalidity the Trial Court held adversely to plaintiff [Finding No. 17, R. 94-95]. It is believed, however, that these additional bases of invalidity previously urged below may be properly asserted on this appeal by the plaintiff without benefit of cross-appeal, since plaintiff makes no attack on the decree of the Trial Court, but merely seeks to support the holding of invalidity on these additional bases rejected by the Trial Court (*Lanova Corporation v. National Supply Co.,* 116 F. 2d 235 [C. C. A. 3, 1940]).

According plaintiff has included in the record on this appeal the prior art patents and publications introduced below and the testimony of the witnesses relating to such prior art.

Plaintiff also pleaded [Complaint, R. 10; Answer to Cross-claim, R. 45-46] and urged below [R. 106] the

invalidity of the patent in suit on the ground that it was granted as a result of misrepresentations made to the Patent Office in the file wrapper affidavits of Herman Silversher and Ralph Crump relative to the prior art Bramberry patents. Despite the Trial Court's initial attitude relative to this attack [R. 107-13], the said affidavits were the subject of considerable testimony at the trial, on which the argument was predicated that the Patent Office was led to misconstrue the said Bramberry patents by reason of the untrue allegations of said affidavits. The Trial Court however made no findings or comments in its opinion relative to this subject, which is also argued as an issue herein.

(c) The Patent in Suit.

The Hall patent in suit is entitled "Dry Lubrication Process and Product" and relates to a method of bonding solid lubricant particles, such as powdered graphite, to a metal surface so that the graphite particles will stick to the surface. The patentee accomplishes this by mixing the graphite particles into a thermosetting resinous vehicle and painting the mixture on the metal. The thermosetting resin is then set by baking.

The claims of the patent cover a process which includes the steps of preparing the surface of the metal for the application of the lubricating paint by roughening the surface, then applying the composition of graphite in the thermosetting resin in a thin film, and finally baking the composition to set the resin.

While claiming in *process* form, the patent actually relates to the *composition* which is applied and, more particularly, with the use of the *thermosetting* resin as the material for holding the graphite to the metal surface. This composition may be most readily conceived in non-technical terms as a type of coating material like a paint. Instead of color pigment found in the usual paint, there

is dispersed in the vehicle a lubricating material such as graphite in the form of fine particles [R. 125]. The problem dealt with in this patent is how to get the graphite to stick to the metal. The alleged novelty lies in the use of a thermosetting resin in the vehicle in which the graphite is suspended, which resin is set to a hard film by baking it [R. 64-65].

There are seven claims in the patent in suit: basic claim 1 and claims 2 to 7, inclusive, dependent thereon.

Claim 1 reads as follows:

> "1. A process for lubricating the surface of an element that is subjected in use to mechanical friction, that comprises treating the surface to form a large number of substantially microscopic irregularities therein, applying to the surface an abrasive-free coating mixture consisting essentially of liquid and a large number of finely divided solid lubricant particles distributed within the liquid in a proportion sufficient for coating of substantially said entire surface by the particles, said liquid including an uncured thermosetting polymerizable resin bonding agent, and baking the coating to polymerize and harden the thermosetting resin and thereby tightly bond the solid lubricant particles in place on said irregularized surface, said coating having upon drying a thickness under 1/1000 of an inch."

Claims 2 and 3 are drawn specifically to the lubricant solids graphite and molybdenum disulphide, respectively; claims 4 and 5 define the specific method of surface irregularization prior to applying the lubricating paint, by phosphatizing and sandblasting, respectively; claim 6 sets forth a specific formula for the amount of lubricant particles in the liquid vehicle; and claim 7 is a product by process claim, again dependent on claim 1.

Since the patent and prior art employ various technical terms, the meaning of which appeared to merit some preliminary elucidation, plaintiff's initial efforts in the trial of the case were devoted to reducing the meaning of these terms to lay understanding through the testimony of plaintiff's expert Dr. John Burnham and explaining the purpose and function of the process of the patent in suit, as well as the meaning of the claims [R. 119-171].

Dr. Burnham explained that the patent in suit dealt with a solid lubricant film containing dry or solid lubricant materials, particularly graphite and molybdenum disulphide (also called "molybdenum sulfide" or "molysulfide, MoS_2") [R. 126], which substances have the known property of reducing friction [R. 127]. Graphite alone does not stick readily to a metallic surface, and it must be adhered with a binder which, like the vehicle of a paint, binds the particles to the surface [R. 128]. Similarly, molybdenum disulphide must be bound to the surface if substantial amounts of this material are to be adhered [R. 128].

The Hall patent deals with a process of bonding solid lubricant particles to a metallic surface using a resinous bonding agent [R. 129, PX-1, col. 1, line 46]. A resin is a noncrystalline material made of large molecules called "polymers" [R. 132-33]. Resins have a natural vegetable origin, but a large class of synthetic materials are known as synthetic resins because of their similarities to the natural resins [R. 133]. Resins are also classified as thermosetting or thermoplastic, and the Hall patent in suit discloses and claims the use of a *thermosetting* resinous bonding agent or vehicle to adhere the solid lubricant particles to the metallic surface [R. 133; PX-1, p. 1, col. 1, line 79, to col. 2, line 5; col. 2, lines 12, 18-20; claim 1, p. 2, col. 4, lines 2 and 4].

Thermosetting resins are defined as those which are converted into a hard infusible solid by the action of heat, light, or a catalyst or as defined in the *Modern Plastics Encyclopedia* for 1949:

> "Having the property of undergoing a chemical reaction by the action of heat, catalysts, ultraviolet light, etc., leading to a relatively infusible state." [R. 134.]

A thermosetting resin, upon being heated, becomes hard and insoluble in many solvents, including the one in which it was originally dissolved, and it will not resoften upon heating again; while a thermoplastic resin is one which remains soluble after being heated and will resoften if reheated and will do this repeatedly [R. 135].

This change of state of a thermosetting resin, which occurs through polymerization, was originally known to result only upon the application of heat, but more recently other means, such as light and catalysts, were found to set certain resins [R. 134-35]. Whether the action occurs through application of heat or by catalysts, the same physical and chemical results are achieved—that is, there are formed certain three-dimensional cross-linkages between the long chain polymers of the resin resulting in an infusible material [R. 135-44].

Perhaps the most lucid explanation of the term was provided by the witness Dr. Dawe on cross-examination, wherein he stated:

> "Q. (By Mr. Young): I am asking you what you understand the term thermosetting to mean?
>
> * * * * * * * *
>
> "A. The term thermosetting is a fairly loose term. It is defined with different emphasis by different people. Originally in resin technology when the first synthetic resins were applied it was observed that

resins seemed to fall in two categories, those which were definitely thermoplastic, that is, when you heated them they softened and when they cooled they again hardened and again softened on reheating and so on and no permanent change, and other resins which, after they were once heated, changed to an infusible and insoluble state and which after cooling and reheating did not again become soft. Now, this difference or this property of solidification and becoming infusible on heating has been found through investigation to be the result of a certain type of polymerization which results from cross-linking and building up a three-dimensional network and such a network has the characteristics of being nonsoluble and nonfusible. There are certain resins which under the influence of certain catalysts will set up this network even though they are not baked. Other resins you have to heat to induce this reaction. Those which can be induced to form this network catalytically or under the influence of certain trace amounts of added chemical materials can also, of course, be conventionally thermoset by application of heat. In general, the important characteristic, the important property which characterizes a thermosetting resin, is one which will set up or can form this three-dimensional polymeric structure which is insoluble and infusible on the application of heat." [R. 1309-11.]

The more common synthetic thermosetting resins include phenolformaldehyde resoles, and "B" stage phenolformaldehyde resin falls within this group [R. 145]; urea formaldehyde and alkyd resins are further examples of synthetic thermosetting resins, the latter being often set by use of driers or catalysts such as cobalt napthanate [R. 146]. Most natural resins are thermosetting, including japans which are mixtures of oils (which are con-

vertible to resins) and natural resins. These are generally thermoset by the action of heat [R. 1319], but the action may be accelerated by the use of driers [R. 147-48]. Asphaltic resins found in asphalt or petroleum residue are thermoset by heat in the presence of air when in the form of a thin film [R. 148, 1318-19].

In the Hall patent in suit the patentee suggests the use of a thermosetting resin ("B" stage phenolformaldehyde resin) incorporated into the vehicle, which is a thermoplastic resin mixture of vinyl chloride and vinyl acetate plus a plasticizer and solvent [PX-1, p. 1, col. 2, line 9]. The use of the thermosetting resin is essential to the objects of the invention recited by the patentee [R. 148-53]. The plasticizer mentioned as incorporated in the vehicle, is a chemical which softens the resin. It is not to be confused with an elastomeric resin, since a plasticizer is not a resin [R. 163]. The solvent is the liquid portion of the vehicle which acts like a paint thinner—it is the liquid in which the thermosetting and thermoplastic resin and plasticizer are dispersed [R. 163-64].

Into this vehicle the Hall patent discloses the addition of lubricating solids, graphite being preferred. In extreme cases up to ninety per cent of the graphite may be replaced by molysulfide [R. 164; PX-1, p. 1, col. 2, lines 67-81].

The application of this composition of a vehicle containing a thermosetting resin in which graphite or other lubricating solid is dispersed involves as a first step the microscopic roughening of the surface to receive the coating. This is done by conventional methods, such as sandblasting or phosphatizing [PX-1, p. 1, col. 1, lines 62-71]. This step is set forth in claim 1 as "treating the surface to form a large number of microscopic irregularities therein."

The next step is the application of the composition by any suitable means, such as spraying, dipping, or brushing. This step is claimed as follows (bracketed inserts ours):

> "applying to the surface [brushing, dipping, spraying] an abrasive-free coating mixture consisting essentially of liquid [thermoplastic resin, plasticizer, and solvent] and a large number of finely divided solid lubricant particles [graphite or graphite and molybdenum disulphide mixture] distributed within the liquid in a proportion sufficient for coating of substantially the entire surface by the particles [covering the surface], said liquid including an uncured thermosetting polymerizable resin bonding agent [thermosetting resin, uncured, i.e. not yet set]."

The term "abrasive-free" simply means that no sand or grit is included in the vehicle, while the phrase "in proportion" etc. is somewhat unclear but may be interpreted to mean that the number of solid lubricant particles present are sufficient to cover the surface [R. 169]. The word "polymerizable" in the phrase "uncured thermosetting polymerizable resin" is purely redundant, since an uncured thermosetting resin is by definition polymerizable [R. 170].

After the application, the next step is baking, which is expressed in the claims "and baking the coating to polymerize and harden [set] the thermosetting resin and thereby tightly bond the solid lubricant particles [graphite] in place on said irregularized surface."

Finally, the patentee states that the coating is under 1/1000 of an inch, by adding to the claims, "said coating having upon drying a thickness under 1/1000 of an inch". This thickness is purely a matter of choice, as indicated

in the specification [p. 2, col. 3, lines 8-14], where the patentee states:

> ". . . Coatings applied in accordance with my invention may be made very thin so that the total thickness is only one thousandths of an inch or less, thus being satisfactory even though the tolerances permitted for the part being treated are very small. Thicker coatings, may, of course, be applied if desired."

Stripped of the verbiage of the claims, the heart of the claimed invention of the Hall patent in suit is the use of the thermosetting resin in the vehicle in which the graphite is dispersed. As stated by Dr. Burnham [R. 170-71]:

> "Q. Now, from your study of the patent in suit, could you tell us what you consider to be the gist or essence of the invention which is set forth in this claim which you have just described?
>
> "A. Well, I believe that the gist of the invention, as indicated by the patent, is the use of this uncured thermosetting resin bonding agent in the vehicle, since the other operations which are indicated here are all indicated in the patent to be conventional steps, that is, there are conventional ways of roughening used, there are conventional ways of applying the film, spraying, painting, and so on. The baking step is conventional, since this is necessary to cure a thermosetting uncured resin, and insofar as the thickness is concerned, there is no place in the specifications which indicates that one thickness or another produces a better or a worse result, but in fact allows, as I read it, the thickness to be a matter of choice, depending on what end result one is to achieve, what application that one has."

This is further borne out by the file wrapper of the patent in suit.

(d) The File Wrapper History of the Hall Patent.

In determining the nature of the alleged invention of the Hall patent in suit, it is important to study the long and protracted history of the application through the Patent Office.

In this case the file wrappers PX-2, 2-A and 2-B are particularly illuminating as to the alleged advance in the art claimed by the patentee. In addition, the file wrappers include by way of affidavits considerable argument and comparative tests designed to establish the superiority over the prior art process of Bramberry, the most pertinent Patent Office reference, and the differences between the Bramberry disclosures and the claims of the Hall patent.

The affidavit by Ralph E. Crump, defendant's employee, which resulted in an allowance of the application, is reprinted from the file wrapper in the appendix to this brief. The result of this affidavit was a misconstruction of the Bramberry patents by the Patent Office and a consequent allowance of the Hall patent thereover. This point will be more fully discussed under the discussion of the prior art *infra.*

The application for the patent in suit was first filed on April 13, *1946,* and was abandoned after repeated rejection of the claims by the Patent Office [PX-2]. A first continuation-in-part application was filed on April 26, 1950, in which considerable new matter was added, including the use of molybdenum disulphide as a lubricating solid, as set forth in column 2, lines 74-81, of the patent in suit [PX-2, pp. 2-9; PX-2-A, p. 11]. The patentee's disclosure of the use of other organic resins, such as "silicone resins, alkyd resins and other vinyl resins" in lieu of the mixture of the copolymers of vinyl chloride and vinyl acetate with "B" stage phenolformaldehyde resin specified in the original application [PX-1, col.

2, lines 13-15], was also added in this new application filed in 1950 [PX-2, pp. 2-9; PX-2-A, pp. 2-12].

The 1950 continuation-in-part application [PX-2-A] included claims to another alleged invention which involved the use of an undercoat of low melting point metal on which the composition including graphite in a thermo-setting resin was applied. It also included claims to the process in suit, omitting the undercoat of low melting point metal. On these latter claims the application was repeatedly rejected over Patent Office reference to the patents to Larson, No. 2,466,642, McKee, No. 1,603,086, Parker, No. 2,335,958, and finally Bramberry, Nos. 2,434,880 and 2,534,406.

In arguing the first rejection, applicant stated with respect to Larson [PX-2-A, p. 24] that Larson's resins "are not *heat hardenable* compounds of the kind employed by applicant and would not serve to bond the graphite or other solid lubricant to a friction surface." "It is believed clear, therefore, that the Larson patent likewise fails to anticipate even *the gist of applicant's invention* because it does not suggest or tell how to bond graphite to a friction surface" [PX-2-A, p. 24].

After the next Patent Office rejection on the patent to McKee, applicant argued that this patent "does not include any thermo-setting type of bonding material" [PX-2-A, p. 32]. Thereafter, applicant's counsel interviewed the Examiner and filed an amendment and affidavit by Herman Silversher, Chief Research Chemist of Electrofilm, the assignee of the application. In his amendment counsel for defendant argued "that the Parker and McKee patents do not disclose compositions which are essentially thermosetting in character" [PX-2-A, pp. 38-39].

The witness Silversher in his affidavit also distinguished the prior art on the basis that it disclosed no use of a

thermosetting resin. At the trial he testified on this point [R. 361]:

> "Q. (By Mr. Kern): I call your attention to pages 40 to 43 of the second file wrapper of the Hall application, Exhibit 2-A, and I will ask you if you are familiar with what is shown there, and if you would please tell us what it is.
>
> "A. Yes, I made up—this is an affidavit, and it bears my signature. The purpose of this affidavit was to distinguish Parker and McKee and the Hall application, and that the Parker and McKee patents employed a thermoplastic resin, and the Hall composition was thermosetting, and further to show that the thermoplastic resins of Parker and McKee would not perform as well as the thermosetting resin of the Hall process."

Subsequent to the Silversher affidavit, the Patent Office again rejected these claims, stating that:

> ". . . Applicant's argument, the Silversher affidavit and the Reprint have been carefully considered but are not persuasive that these claims are patentable over the applied references. . . ." [PX-2-A, p. 49.]

The patents to Bramberry, Nos. 2,434,880 and 2,534,406, were then, after citation by the Patent Office, the subject of a further affidavit by Mr. Silversher in which he argued that Bramberry did not employ a thermosetting resin in his binder [PX-2-A, p. 63]. However, the Examiner continued to disallow these claims, while approving claims covering the other process using the low melting point metals, whereupon applicant on April 21, 1954, filed a third application, as a division of the second, in which were included the claims to the process in suit [PX-2-B].

In this third application the Examiner again relied on Bramberry No. 2,534,406 and the patent to Bloomenthal, No. 2,085,413, in rejecting all claims. Thereafter, counsel for applicant interviewed the Examiner on three occasions in the company of defendant's expert, Ralph Crump [PX-2-B, p. 36], who subsequently to the last interview submitted the affidavit [PX-2-B, p. 51 (appendix)] which resulted in an allowance.

This affidavit was devoted to distinguishing over Bramberry and the other references cited by applicant as a result of applicant's allegedly thorough search. In so doing, Crump argued, as had been argued in the two prior applications, that none of the prior art showed the use of a thermosetting resin in the binder to hold the graphite to the metal, and that this substitution of thermosetting resins for the allegedly inferior thermoplastic resins of the prior art constituted invention.

Said Mr. Crump on this vital point:

> ". . . In view of the teachings, it would certainly not have occurred to an ordinary person skilled in the art that a thermosetting resin might actually be preferable over a thermoplastic resin in a solid film lubricant, and consequently the use of such a resin by Hall amounted to an inventive advance over Bramberry. . . ." [PX-2-B, p. 46.]

After the submission of this affidavit, the patent was granted in March of 1955, nine years, ten rejections, five interviews, and three affidavits after original application therefor. It is noteworthy that, throughout this entire period of never-say-die prosecution, applicant contended that it was the use of a *thermosetting resin* in the Hall process that constituted the gist of the invention alleged and the asserted advance over the prior art [R. 171-78]. This is in counterdistinction to defendant's repeated argument during the trial of the case that the surface irregularization was a vital feature of the process

(e) Prior Knowledge and Use, Prior Public Use, and Prior Invention at Bell Telephone Laboratories and Western Electric Company.

(1) The Burns Development.

Mr. Robert Burns was employed by Bell Telephone Laboratories, the research agency for Western Electric Company, from 1919 until 1954, working in the general field of organic dielectrics and plastics and evaluation and engineering use thereof, being responsible for the engineering phases of finishes [R. 1326]. In 1934, Mr. Burns was assigned the problem of making a piece of apparatus work which did not work before because of chattering and lack of a smooth enough finish between two contacting metal parts [R. 1327]. Using materials which were available in the laboratory in which he worked, Mr. Burns developed a process for permanently lubricating a surface [R. 1328], which process was made the subject of an application for patent filed March 26, 1936 [PX-44-A, R. 1761 *et seq.*] and Bell Telephone Laboratories specification LRM-2064, Issue 1, Baked Lubricating Finish, No. 495 Finish, issued February 11, 1936 [PX-44-B, R. 1788 *et seq.*].

The Burns patent application describes a process of preparing a durable permanent lubricating finish including the steps of applying a mixture of baking japan, flaked graphite, and thinner to the article to be coated by dipping, brushing, or spraying, allowing the coating to dry in air until the greater part of the solvent has evaporated and then hardening the finish by baking in an oven at approximately 400° F. for about an hour or at 250° F. for ten or twelve hours. This process produces an enduring graphitic film which is substantially nonoxidizing and is soluble only in strong acids or alkalies. It should be specifically noted that the baking process was described as necessary to polymerize the finish and

thus make it stable and enduring [R. 1772]. Mr. Burns testified that the japan which he employed was thermosetting; that the china wood oil and the refined linseed oil in the japan imparted its thermosetting qualities [R. 1333-34]. In the Burns process, the surface of the baked finish may be burnished to reduce the thickness to the desired value, which can be done with a paper clip, but preferably with a burnishing tool. However, such burnishing does not disturb the permanent graphitic film on the surface of the part [R. 1765]. The Burns material was applied to brass, steel and zinc-electroplated steel [R. 1348].

Following two Patent Office rejections and two amendments by the applicant, the Burns application was finally rejected for lack of invention over the showing of the patents to Ridd No. 988,664 and Wescott No. 1,034,174, and the application was abandoned.

The specification based on the Burns invention, LRM-2064, Issue 1, covered a baked lubricating finish "used to impart low-friction characteristics to rubbing surfaces and requires no further attention during the life of the apparatus" [R. 1789]. The material was specified for application to surfaces which were prepared by various methods, including scratch brushing, sandpapering, and zinc plating [R. 1790]. The mixture comprised black japan, graphite, and carbon tetrachloride or mineral spirits, applied by brushing, dipping or spraying to the part which had been previously prepared [R. 1790-1791]. After drying in air, the coated parts were baked in an oven at 375° F. to 400° F. for one hour or overnight at 250° F. [R. 1791]. After cooling, the parts are burnished to leave a smooth graphitic surface exposed and adhering to the metal [R. 1792].

Metal surface preparation by scratch brushing, sandpapering, electroplating, and bright acid dipping provides

microscopic irregularities in the surface. Mr. Burns testified that zinc-electroplated steel has a fairly rough surface and that any electroplated surface has a certain amount of roughness to it that you can't avoid [R. 1348]. Dr. Burnham also testified that zinc plating produces a large number of microscopic irregularities on the surface [R. 861]. A zinc plated steel panel [PX-52] was examined by Dr. Burnham and the Court with an eighty power microscope. Dr. Burnham described the surface as containing a large number of craters and peaks and valleys uniformly covering the surface. The Court indicated that the surface looks like one "that would be induced by taking a rough steel wool and rubbing a soft metal surface" [R. 861-863]. The photomicrograph [PX-54] of the zinc plated surface confirms the results of this inspection. Both the panel and the photomicrograph were authenticated by certificates of the parties preparing them [PX-53, 55, R. 1843, 1845].

Dr. Burnham also testified that chrome plating roughens the surface of the metals to which it is applied [R. 865-867]. A chrome plated panel [PX-56] was examined by Dr. Burnham and the Court through the eighty power microscope. A photomicrograph [PX-58] of the chrome plated surface clearly shows the microscopic irregularities produced by the plating operation.

Dr. Burnham also testified that bright dip or bright acid dip on copper provides a rough surface showing craters and peaks all contiguous over the entire surface [R. 871, 872]. A copper plated panel [PX-59] which had undergone a bright dip for three minutes was inspected under the microscope by Dr. Burnham and the Court and a photomicrograph [PX-60] was provided showing the irregular surface of the panel.

Black japan is thermosetting, *i.e.*, it is a mixture of materials [R. 1764] some of which thermoset to make

the mixture permanently hard and insoluble [R. 1334, 146-148]. The testimony of Dr. Burnham on this point is particularly significant [R. 147-48]:

> "Q. Are these [japans] thermo-plastic or thermo-setting?
>
> "A. These are generally thermo-setting.
>
> "Q. How are the japans set or cured?
>
> "A. They are generally set by heat, but they can be accelerated—the process can be accelerated by the use of dryers and other catalysts."

Black japan polymerizes with heat to form a three-dimensional cross-linked polymer when applied in film form producing a hard, insoluble, and infusible film which meets the requirements of a thermosetting material under any of the definitions given in this section [R. 879-80]. The mechanism of thermosetting of the black japan is different from the mechanism of thermosetting of phenol-formaldehyde in that the black japan acquires oxygen from the air in forming the cross-linkages [R. 880].

This testimony of Dr. Burnham is confirmed by the tests conducted by defendant's expert Mr. Bush, which tests are reported in defendant's Exhibit AI, which is designated as a physical exhibit and not printed in the record.

Mr. Bush's report comparing the properties of the Hall resin and black japan was analyzed by Dr. Burnham, who concluded [R. 880-82]:

> "Q. I would like to refer you to Mr. Bush's report and ask you whether it appears that black japan differs materially in solubility from the Hall material listed there, when it is in film form?
>
> "A. . . .
>
> "In comparing these two columns together, I would say there is relatively no significant difference in the solubility of these two films.

"The only real difference shown here is that in the aromatic hydrocarbon, where it says the Burns black japan softens, but it doesn't say it is soluble. It merely means it changes its hardness.

"Q. Well, is there anything indicated about the comparative hardness of the two films on that page? Right above what you have been reading.

"A. Well, it says—it is indicated to have toughness here. It says, 'Above-baked films were of comparable hardness.' So that this means, I would say *the two films are essentially of equal hardness, equally resistant to solvents, with the slight edge in the aromatic hydrocarbon for the Hall binder.*"

While Mr. Bush does not apply the term "thermosetting" to the hardening of japans in film form when heated in the presence of oxygen, it is clear from his testimony that the same physical and chemical phenomena occur in the hardening of the Hall bonding material consisting of a mixture of "B" phase phenolic resin and copolymers of vinyl chloride-acetate and in the hardening of the black japan. Because oxygen enters into the reaction, Mr. Bush does not consider this hardening a thermosetting action in the case of the japan, but this is merely a matter of definition [R. 833-35].

The Burns process as set out in Bell Telephone Laboratories specification LRM-2064, Issue 1, was adopted by Western Electric Company in 1936 and identified as Baked Lubricating No. 495 type Finish. See Bell Telephone Laboratories specification LRM-2064, Issue 1 [PX-44-B, R. 1788 *et seq.*], correspondence between Bell Telephone Laboratories and Western Electric [PX-46-A, B, C, D, E, F, R. 1806-11], and Western Electric Company specification for No. 495 type Finish [PX-47-A, R. 1812 *et seq.*].

The Western Electric Company planned to use the process on eight thousand parts per year in 1936 [R. 1809].

While the Burns *application* for patent was abandoned, it is clear from this and subsequent specifications and uses (to be discussed *infra*) that the Burns *"invention"* was never abandoned.

(2) The Campbell Development.

Wilfred E. Campbell is a scientist and a specialist in the fields of lubrication, prevention of metal tarnishing, and analytic chemistry, having been engaged in these fields since 1926. Dr. Campbell was employed at Bell Telephone Laboratories from 1926 to 1954 working in the research department [R. 1371-74].

During 1934 and 1935, Dr. Campbell's department was involved in the same emergency research work on solid lubricant coatings as Mr. Burns, the problem being to find as rapidly as possible a suitable lubricant film for the contact finger of a new cross-bar switching system [R. 1375-76]. A number of various materials were tested, including a product of Acheson Colloids Company known as "Varnodag". Varnodag contained colloidal graphite dispersed in a phenolformaldehyde resin and was sprayed onto the surface and baked thereon. The Varnodag provided very long life and reduced the friction appreciably, but not quite as low as desired by the project engineers [R. 1377].

A new mixture was subsequently prepared by Dr. Campbell comprising an alkyd resin known as "Beckosol" and graphite [R. 1379]. A series of mixtures using various percentages of graphite in this resin were prepared, applied to steel plates, baked, and then tested for wear and friction. The tests indicated that a mixture of approximately fifty parts of resin and fifty parts of

graphite by weight provided the "desired properties of low friction as well as long life" [R. 1380-81]. These compounds were applied to panels which had previously been treated with an abrasive cleaning method using an abrasive known as levigated alumina, the compounds being thereafter applied by spraying [R. 1382]. The coatings tested were in the order of one-half of one thousandth of an inch [R. 1381-82].

Beckosol is an alkyd resin of the thermosetting type which is thermoset by baking [R. 1380]. Dr. Campbell knew that Beckosol was thermosetting from his tests [R. 1406] as well as from the manufacturer's specification [R. 1403]. However, Beckosol may also be hardened or set by the addition of catalysts or driers which speed up the polymerization of the thermosetting resin making it harden or set at room temperatures [R. 1383, 893].

In further testing his compositions, particularly to ascertain the comparative merits thereof as against the Burns black japan binder, Dr. Campbell applied lubricating compounds on steel plates, utilizing Beckosol and graphite which were set at elevated temperatures. He also applied coatings of Beckosol with a catalyst and graphite which were set at room temperature, and lubricating coatings of the type developed by Mr. Burns [R. 1379-84].

After the films were hardened, the various panels were tested for friction and wear life. Dr. Campbell's tests indicated that the friction of the three compounds was of the same order, while the wear life of the three materials varied slightly, with the baked Beckosol composition having the longest wear life [R. 1383-84].

In 1934 or 1935, Dr. Campbell developed a composition consisting essentially of liquid and a large number of finely divided solvent lubricant particles distributed

within the liquid in a proportion sufficient for coating of substantially the entire surface by the particles, which liquid included an uncured thermosetting polymerizable resin bonding agent. After application of the composition to a surface, the article was baked to polymerize and harden the thermosetting resin and thereby tightly bond the solid lubricant particles in place. The resultant coatings had a thickness of under one one-thousandth of an inch. This composition was abrasive free but was applied to surfaces which had previously been treated by an abrasive cleaning method [R. 1391-93].

On January 3, 1938, a revised specification LRM-2064, Issue 2 [PX-45-A, R. 1793 *et seq.*] was issued by Bell Telephone Laboratories, superseding Issue 1 of the same specification [PX-44-B], which set out the Burns process previously discussed. The new specification retained the Burns process designated Baked Finish No. 495 and included, in addition, the Campbell process utilizing Beckosol and a catalyst, which process was identified as Lubricating Finish, Air Dried No. 517 [R. 1387].

On August 9, 1943, Issue 2 of the specification was superseded by Issue 3 [PX-45-B, R. 1800 *et seq.*]. In this specification, the Campbell composition utilizing Beckosol, a catalyst, and graphite is substituted for the Burns composition utilizing black japan, a thinner, and graphite in Baked Finish No. 495. The mixture of Beckosol thermosetting resin, drier-catalyst, solvent, and graphite was found suitable for use both for polymerizing the resin at elevated temperatures by baking and at room temperatures [R. 1388-89, PX-47-C, R. 1817].

In summary, Issue 1 of the Bell Telephone Laboratories specification was effective during the period February 11, 1936, to January 3, 1938. This issue specified only the Burns black japan baked on coating process, which was identified as Finish 495. Issue 2, effective January 3,

1938, to August 9, 1943, specified both the Burns coating as Finish 495 and the Campbell Beckosol with catalyst air dried coating as Finish 517. Issue 3, effective from August 9, 1943, to date, specified the Campbell Beckosol composition for use both as a baked on coating, Finish 495, and an air dried coating, Finish 517, the Campbell coating substituting for the earlier Burns in Finish 495.

Dr. Campbell saw his composition in use in approximately 1940 at Western Electric on the armature of a relay where wear and impact were severe [R. 1390].

Thus, it is seen that Dr. Campbell developed and successfully reduced to practice a process including all of the steps of the Hall process long before Hall's alleged invention thereof, and the Campbell process was never abandoned.

(3) Use of the Burns Process in Production at Western Electric Company.

Arthur M. Wagner, who holds a doctor's degree in Chemical Engineering, has been employed by the Western Electric Company from 1929 to the present. He originally worked in the organic finishing department, which is concerned primarily with paints, varnishes, and lacquers, and is now Superintendent of Development Engineering and still has charge of organic finishes [R. 1466-71].

Dr. Wagner identified Western Electric Company's specification for Baked Lubricating No. 495 type Finish [PX-47-A, R. 1812 *et seq.*], which sets out the Burns process as discussed above and corresponds to Bell Telephone Laboratories specification LRM-2064, Issue 1 [PX-44-B, R. 1788 *et seq.*]. Dr. Wagner saw the lubricating finish including black japan and graphite in use in 1937 and 1938 at the Western Electric Plant. The material is applied pursuant to the specification both by brushing and by spraying. Some of the parts were acid etched prior to application, and some were zinc plated.

The Burns process as exemplified in the No. 495 type Finish was continued in use at the Western Electric Plant until 1943 [R. 1469-77, PX-47-C, R. 1817, PX-47-I, J, K, L, R. 1827-37].

Mr. Morris Brown, a chemical engineer, has been employed by the Western Electric Company since 1923 and was Dr. Wagner's predecessor as Department Chief of the Finishing Group, Organic and Inorganic, holding that position from 1936 to 1939. Mr. Brown is presently Assistant Superintendent of Operating, manufacturing cross-bar switches [R. 1411-17].

It was stipulated by counsel for both parties that Mr. Brown, if asked about witnessing the application of finishes compounded of black japan and graphite and their application on parts made at Western Electric, would testify to the same effect as had Dr. Wagner [R. 1418].

Mr. Thorllif Thovsen has been employed by the Western Electric Company in Chicago as a sprayer from 1925 to the present. During the period 1937 through 1941, Mr. Thovsen applied a coating consisting of a mixture of black japan, graphite, and a thinner to an average of *one thousand pieces a month.* After spraying and air drying, these parts were baked in ovens at 300° to 350° F. for one to two hours or more. This mixture was applied to the parts shown on plaintiff's Exhibits 47-G and 47-H [R. 1824, 1825]. Prior to going to work as a sprayer, Mr. Thovsen worked in the zinc plating department. The parts to which the graphite-black japan mixture was applied were zinc plated. The spray room where Mr. Thovsen mixed the materials and sprayed the parts was open to other employees and visitors, and he was never instructed to maintain any of his information secret [R. 1543-69, 1574].

Furthermore, defendant in its opening brief admits that the Burns process as exemplified by Finish No. 495 was in use at the Western Electric Plant until 1943 [Brief, pp. 10-12].

(4) Use of the Campbell Process in Production at Western Electric Company.

As discussed *supra* in connection with the Campbell process and the testimony of Dr. Campbell, Beckosol was substituted for black japan in the No. 495 Baked Lubricating Finish in 1943. The evidence previously discussed is corroborated by the testimony of Dr. Wagner [R. 1476-77, 1490-91] and inter-company correspondence [PX-47-C, R. 1817]. Plaintiff's Exhibit 47-C, dated May 29, 1943, states that black japan was no longer used as a vehicle for the No. 495 Baked Lubricating Finish and the Beckosol No. 1303 specified for the No. 517 Air Dried Lubricating Finish was now employed for *both the air dried and baked finishes.*

Dr. Wagner testified that he recognized the parts illustrated in Plaintiff's Exhibits 47-D and 47-F [R. 1818, 1822] as parts which were used in communication equipment manufactured by Western Electric [R. 1497, 1509]. He further testified that he had observed the parts shown in Plaintiff's Exhibit 47-F being processed at Building 32-4 of the Hawthorne Plant of the Western Electric Company where the lubricating mixture was applied to the surfaces marked "X" on the drawing [PX-47-F] by spraying, the surfaces being zinc plated prior to spraying. Following the spraying, the parts were baked in ovens in the same building at temperatures in the order of 330° or 350° F. At one time the baked part was burnished, while at another time the burnishing step was omitted. The thickness of this particular coating was in the order of three thousandths of an inch; however, there was no specification on the maximum thickness,

since it did not matter in connection with this part [R. 1533-37].

Plaintiff's Exhibits 47-D, 47-E, 47-F, 47-G, and 47-H [R. 1818-25] are prints of tracings made by the Western Electric Company's blueprint room at Dr. Wagner's request, by Western Electric personnel. The tracings from which the prints were made were produced by Dr. Wagner and were compared with the prints by Dr. Wagner and counsel for defendant. The tracings are regular Western Electric Company working drawings and are customarily kept in the company files and were obtained from the files at Dr. Wagner's request. Dr. Wagner identified the tracings and the prints as being made and used in the regular course of business of the Western Electric Company [R. 1492-1501, 1506-11]. It should be noted that these drawings did not come from the one and one-half inch thick folder of papers repeatedly referred to by defendant in its opening brief.

It is felt that any lack of continuity in Dr. Wagner's testimony is due to the continuous and lengthy interruptions and objections interposed by counsel for defendant. For example, see the record starting at 1469 and at 1477, where the witness is completely distracted by interruptions. This procedure continued throughout the Wagner deposition, as well as in the Brown, Reynolds, Crankshaw, Buck, and Thovsen depositions. It is plaintiff's contention that such interruptions went far beyond that required of diligent counsel and were designed to distract the witnesses and counsel and obscure the testimony.

In considering the following discussion relative to the Western Electric drawings, Plaintiff's Exhibits 47-D, 47-E, and 47-F [R. 1818, 1820, 1822], it is suggested that the Court may wish to view the original exhibits, as the photoreproductions in the record are on a reduced scale resulting in loss of legibility of some of the lettering thereon.

Plaintiff's Exhibit 47-D shows a blade and collar assembly, No. P-294484. As indicated in the upper left corner, the drawing was issued as Issue 1 on November 3, 1939, and Finish No. 495-A was not then specified thereon. The drawing was changed and reissued as Issue 2 in its present form on June 21, 1940, calling for "bright acid dipped and baked lubricating 495-A finish."

Dr. Wagner testified that the 7-B telegraph key on which this blade and collar assembly is used *is still in production* [R. 1498]. It should be noted that in 1940, Baked Lubricating 495-A Finish was covered by specification LRM-2064, Issue 1 [PX-44-B, R. 1788 *et seq.*] which embodied the Burns process. 495-A specifically relates to application of the mixture to a surface without prior preparation of the surface by the party applying the mixture [R. 1790]. However, the drawing [PX-47-D] which specifies this 495-A Finish *also specifies that the part shall be bright acid dipped before application of the finish,* thereby providing the microscopic irregularities on the surface prior to application of the mixture.

In 1943 the Campbell process using Beckosol was substituted for the Burn's process using black japan in the Baked Lubricating 495 Finish, and under Issue 3 of LRM-2064, the baked lubricating finish specified on the drawing required the Beckosol resin [PX-45-B, R. 1800 *et seq.*]. Thus, it is seen that both the Burns process and the Campbell process were used in production on the part shown in Plaintiff's Exhibit 47-D, and in both instances the composition was baked after application to a roughened surface.

The drawing of Plaintiff's Exhibit 47-E was issued October 12, 1936, as indicated in the upper left corner thereof. Reference to the note headed "Issue 3" indicates that, when the drawing was reissued as Issue 3 on June 29, 1939, the requirement for nickel chromium plate was deleted, and zinc plate and 517 air dried lubricating finish

were substituted therefor. It will be recalled that the 517 air dried finish was first specified in specification LRM-2064, Issue 2 [PX-45-A, R. 1793 *et seq.*] and embodied the Campbell process using Beckosol and a catalyst, so that the finish would polymerize and set at room temperature.

Reference to the upper left corner of drawing P-454327 to P-454330 [PX-47-F, R. 1822] indicates that Issue 10 of this drawing was issued on April 13, 1946, which corresponds exactly to the earliest date of invention alleged by the patentee Hall. On that date the drawing was "redrawn without change" from the earlier issue, Issue 9. Thus this drawing on its face is a continuation without change of the drawing which existed prior to April 13, 1946, namely Issue 9. At the present time, the parts shown on this drawing are zinc plated and provided with 289-A finish, which finish is not pertinent to the present action. However, as indicated in the note under Issue 12 (upper left corner), prior to March 31, 1947, the date of said note, the finish called for on these parts was zinc plate 289-A finish and baked lubricating 495-A finish. It will be recalled that, after 1943, 495 baked lubricating finish called for Beckosol [PX-45-B, R. 1800 *et seq.*].

Thus, these three drawings of Plaintiff's Exhibits 47-D, 47-E and 47-F corroborate the previously discussed testimony that the processes at Western Electric using black japan and subsequently Beckosol, *the latter both baked and air dried,* were known and in public use at Western Electric prior to Hall's alleged invention thereof.

This evidence is further corroborated by the testimony of Mr. Brown, it having been stipulated that Mr. Brown would testify in the same manner as Dr. Wagner with respect to Plaintiff's Exhibits 47-D, 47-E, 47-F, 47-G, and 47-H [R. 1444], these exhibits having been identified

in the depositions as Plaintiff's Exhibits C, D, E, F, and G, respectively.

Plaintiff's Exhibits 47-G and 47-H [R. 1824, 1825], the testimony of Dr. Wagner [R. 1510-11], and the testimony of Mr. Brown [R. 1444-48] establish that the Campbell process is still in use today. The Western Electric Company has taken a neutral position in this litigation, has made its facilities equally available to both parties, and its employees were represented by their own counsel, Mr. C. B. Hamilton, resident Patent Attorney at the Hawthorne Works, Western Electric Company, during the depositions [R. 1481-82].

(f) Prior Knowledge and Use and Prior Invention at Acheson Colloids.

The depositions of four witnesses were taken at Acheson Colloids, namely, Morris W. Reynolds, Alden Crankshaw, Percy C. Buck, and Dr. Harold J. Dawe.

Acheson Colloids Company is a division of Acheson Industries, Inc. and is in the business of manufacturing colloidal dispersions of solids in fluids and semi-fluids, having been in this business under several different names since 1908. These dispersions comprise various solids, such as graphite, molybdenum disulphide, talc and zinc oxide, in various liquids, such as water, petroleum oil, resins and alcohols, which dispersions are employed by purchasers from Acheson for lubrication coatings, electrically conductive coatings, and for other purposes [R. 1037-40].

The Acheson salesmen are technically trained men who are given the title of and function as service engineers. The object of their position is to work with the customer, understand his problems, and show and explain to him how the Acheson products should be used and why they are beneficial. The actual taking of orders is not considered of importance in the selling philosophy [R. 1181].

(1) Development and Use of "Varnodag."

Mr. Reynolds is a vice president of Acheson Industries, Inc. and has been employed by Acheson or its predecessors since 1926. During the period 1932 to 1953 he was Sales Manager [R. 1037-38].

During the period 1934 to 1941 Acheson produced and sold continually a product comprising graphite dispersed in a thermosetting phenolformaldehyde resin, which was known as "Varnodag" [R. 1044-45]. The trademark Varnodag was registered on January 1, 1935 [PX-40-C, R. 1734], and the product is described in Acheson Technical Bulletin No. 230.1 [PX-40-B, R. 1731 *et seq.*] which was issued and copyrighted in 1934 [PX-40-D, R. 1735].

Mr. Reynolds testified that a Mr. Heer, a salesman for Acheson under Mr. Reynolds' supervision, discussed with Mr. Reynolds in 1940 the approach to a solution of a problem presented by the General Electric Appliance Company, who sought a suitable coating material which would provide a dry film having lubricating properties to be applied to the switch of an electric toaster. Mr. Reynolds and Mr. Heer recommended the use of Varnodag and applied this material to parts furnished by General Electric [R. 1063-67].

This testimony is corroborated by a written report from Mr. Heer to Mr. Reynolds dated June 7, 1940 [PX-40-F, R. 1741] setting out the details of the treatment applied to the parts furnished by the General Electric Appliance Company. Two groups of the parts were treated as follows: the surface was prepared by sanding, a solution of Varnodag in a solvent was applied to the surface, and the material was then baked. In one of these groups, the material was washed with acetone between the sanding and application of Varnodag. Mr. Reynolds identified the report as one which he had received from Mr. Heer.

Mr. Reynolds also identified the signature to the report as that of Mr. Heer, which signature he had seen hundreds of times [R. 1059-60]. Since defendant's counsel expressed doubt that Mr. Heer was employed by Acheson at that time [R. 1062], Mr. Heer's personnel records at the Acheson Company were also introduced as evidence [PX-40-H, 40-I, 40-J, R. 1749-57] with Mr. Heer's signature appearing on the original Exhibits 40-I and 40-J.

The original of the Heer report was placed in the general records of the company and Plaintiff's Exhibit 40-F, which is a signed copy, was retained in Mr. Reynolds' personal file in his office to be used primarily in preparation of comprehensive sales treatises [R. 1128-30].

Mr. Crankshaw who is now Sales Manager of Acheson Colloids Company, started with the company in 1932 as field representative service engineer [R. 1145]. The company first started selling dispersions of solids such as graphite in thermosetting resins for use as dry film lubricants in 1933, the product being known as Varnodag [R. 1146]. Mr. Crankshaw testified as to specific customers who used Varnodag as a dry film lubricant, including Clarostat Manufacturing Company, Brooklyn, New York, Bell Telephone Laboratories, and Ward-Leonard Electric Company, Mt. Vernon, New York [R. 1147-51].

Mr. Buck, now a vice president of Acheson Industries, started with the company in 1919 and in 1932 was Superintendent in charge of production [R. 1184-85]. One project which Mr. Buck was in charge of in 1932 was the development of a suitable dispersion of graphite in a resin such as a bakelite thermosetting resin, which was requested by the sales department [R. 1185]. After some development work, a dispersion consisting of graphite in a resin purchased from the Bakelite Company which was a "B" stage phenolformaldehyde resin, was developed

and given the name Varnodag [R. 1187, 1191-92]. This product was tested by applying it to steel, brass and glass plates by brushing and by dipping, following which the plates were placed in an oven and baked. The Varnodag consisted of a liquid which included an uncured thermosetting polymerizable resin and finely divided solid lubricant particles and provided a hard, smooth, thin coating on baking. The coatings were applied of a thickness just sufficient to cover the surface of the plates. The standard production tests for smoothness, lubricity, and adhesion were applied to these panels [R. 1187-90].

The above testimony establishes that Varnodag, a mixture including a thermosetting resin and finely divided graphite, was applied to metal surfaces which had previously been prepared by irregularizing, the parts being baked to harden and set the resin and provide a smooth film in the order of one thousandth of an inch thick.

(2) Development and Use of Dag Dispersions 35, 38 and 47.

In 1941, Varnodag was replaced by three new products identified as Dag Dispersions No. 35, No. 38, and No. 47, which products are still being marketed by Acheson, as shown by their 1956 catalog Plaintiff's Exhibit 40-A [R. 1042-1044, 1727 *et seq.*].

Dr. Dawe is Research Director for Acheson Industries and has been with the company full time since 1940, having worked with the company as a part-time worker prior to that date [R. 1194-1196]. Dr. Dawe was working in the laboratory at Acheson in 1941 when a problem was presented to the laboratory to develop a dry film composition which would have excellent hardness and good lubricity for use as a rust preventive and lubricating coating. Dr. Dawe testified that Mr. Heer, the same Heer previously discussed, suggested that the laboratory investigate alkyd resins and investigations were initiated using Beckosol 1313, a product of Reichold Chemical

Company [R. 1210-1211]. The laboratory investigations resulted in the development of dispersions 35, 38, and 47 which were combinations of graphite, alkyd resins and aromatic petroleum naphthas, the latter being solvents. Beckosol 1313 was used in dispersion 35 and Beckosol 1303 was used in dispersions 38 and 47. Both Beckosol resins are thermosetting polymerizable resins. 1313 must be baked at an elevated temperature to harden and set. 1303 may be hardened and set at room temperature or by baking [R. 1197]. Dr. Dawe personally worked on the development and testing of these three materials and his dated laboratory notebooks were introduced as Plaintiff's Exhibit 43-A [R. 1198-1221]. The laboratory notebooks have not been printed in the record but have been designated as a physical exhibit.

Mr. Crankshaw testified that sale of dispersions 35, 38, and 47 started in small quantities in 1941 and built up to volume products during the war years. Specifically, he recalled that these products were used by seventy-six different manufacturers of bomb fuse gears commencing in 1941 and continuing through V.J.-Day. The dry film lubricating coatings were used on these parts, because ordinary lubricants would freeze at the low temperatures at high altitudes. The witness identified eleven particular companies in his personal territory at which the dispersions were used in the coating of bomb fuse gears [R. 1152-57].

He specifically described the process of application of the dispersion to gears at the Lux Clock Corporation in Waterbury, Connecticut, where he personally observed the process many times prior to 1945. The gears, which were of brass, were first given a bright dip, sometimes called a bright acid etch, and, after rinsing and drying, were mounted on a rotating table which contained individual spindles for each gear. The gears themselves were rotated so that the parts were exposed to the spray

of material from four separate spray guns. The parts passed through the spray area and on to the drying operation, following which they were dismounted from the conveyor and placed on another conveyor and went through a bank of twenty infrared lamps where they were baked. The parts were rotated while being sprayed to obtain a complete coating while keeping the thickness of the coating down to a point where it would not interfere with the clearance when the gears were assembled in their unit. The thickness of the coating was specified as less than one thousandth of an inch, and his observations of the finished products indicated that the film was not more than one thousandth of an inch thick [R. 1158-62]. The witness visited these plants manufacturing bomb fuse gears in a consulting capacity [R. 1172] and observed daily performance tests of the assembled bomb fuses [R. 1163].

It is significant to note that a specification of the Gilfillan Company [DX-J, R. 1877 *et seq.*] indicates that bright dip is the required pretreatment for copper and copper alloy parts prior to application of dry film lubricants under the Hall patent.

Mr. Reynolds also testified that dispersions Nos. 35, 38, and 47 contained alkyd thermosetting resins with graphite as the lubricating solid dispersed therein. These materials were sold during the war for use on bomb fuse gears to somewhat in excess of fifty manufacturers [R. 1069-72]. The witness specifically described the process which he personally observed in the plant of Process Engineering Company in Chicago between 1942 and 1944. Mr. William Fisher was proprietor of this company, and his process was described by the witness as including the steps of precleaning, acid etch, mounting the gears on the turnstiles, applying the spray, putting them through the baking cycle, and, of course, assembly later on [R. 1090-92, 1134].

The oral testimony of these witnesses who observed the application of these dispersions to bomb fuse gears was further corroborated by a plurality of cards from a company file maintained for war-time material priority purposes, which cards were made from salesmen's reports in the regular course of business by employees under Mr. Reynolds' direction and control, Mr. Reynolds being Sales Manager at the time these cards were being made [R. 1073-76]. Thirteen cards from the file which indicated use of the 35, 38, and 47 dispersions by customers of Acheson were introduced into evidence as Plaintiff's Exhibit 40-G [R. 1742 *et seq.*]. The notations on the cards were interpreted by Mr. Reynolds as indicating that these dispersions were used extensively in production and coating of bomb fuse gears and other parts with dry film lubricant compositions which were in many cases baked on [R. 1077-86].

The cards comprising Plaintiff's Exhibit 40-G were part of a record compiled and maintained during the second World War when the company was badly in need of priorities. The cards were compiled from salesmen's reports by office personnel of Acheson Colloids when the report indicated that Acheson products were being used by a customer who could supply a priority rating [R. 1117-21]. This file was no longer maintained current after 1947 or 1948, although the witness had occasion to look up in the cards a use of material a year or two prior to taking of his deposition [R. 1123-24].

It is clear that Acheson products comprising thermosetting resins containing graphite were applied by Acheson customers to parts which had previously been irregularized by bright acid dip, the application being by spraying, following which the parts were baked to harden and set the resin. Not only was this process for employing their material known to Acheson personnel, but it was actually

suggested and taught by Acheson to their customers, particularly in the war time bomb fuse gear program.

Prior to the initiation of the present suit, the defendant sought to license Acheson under the Hall patent to cover the dispersions including 35, 38, and 47 which Acheson had been manufacturing and selling continually since 1941 [R. 1095-99, 1102].

(g) The Prior Art Patents and Publications.

Plaintiffs' prior art patents and publications relied upon at the trial were introduced to show that each individual step of the Hall process was old in the art of bonding graphite or lubricant solids to metal surfaces, including the particular step which was asserted to be novel during the prosecution of the application, namely the application of the graphite in a thermosetting binder. Plaintiffs also established that the *combination* of steps was old in the art, not only in the Bramberry patents [PX-3, R. 1692-1708], which the Patent Office was led to misconstrue by the Crump affidavit [Ex. 2-B and appendix], but also in other pertinent patents and publications not cited by the Patent Office in the prosecution of the Hall patent in suit.

In reviewing this prior art herein, an effort will be made to group the references which disclose each of the various steps of the process in issue and to discuss separately the Bramberry patents which were the subject of considerable testimony and comparative tests at the trial.

(1) History of the Art.

As a preliminary to his explanation of the prior patents and publications relied upon by the plaintiff, Dr. John Burnham summarized the history of the art of dry film lubrication in order to provide a better over-all picture of the alleged advance in the art made by the patentee.

Dr. Burnham's testimony on this point is believed to be of such interest that it is reproduced in the appendix furnished herewith.

(2) Surface Preparation.

The first step in the Hall patent claims comprises irregularization of the surface. The purpose of such irregularization is to produce microscopic hills or valleys in order to obtain increased adhesion. An irregular surface provides larger surface area, as well as the requisite reservoir areas to hold the solid film lubricant [R. 167-68, 728-30].

This irregularization may be accomplished in a number of ways, as by ordinary sandblasting or by phosphatizing by well known processes as suggested by the patentee [PX-1, col. 1, lines 62-67]. Other methods of surface irregularization which are commonly used are chemical etching, oxide coating, anodizing aluminum, plating with porous zinc or chromium, honing, scratch-brushing, grit-blasting, etc. [R. 167].

Different metals often call for different presurface treatments to create the irregular surface prior to the application of the coating. This is clearly shown in the specifications of North American Aviation Inc. [DX-F, R. 1864] and the specification of Gilfillan [DX-J, R. 1880-81] which were introduced into evidence to prove infringement by plaintiffs in the application of coatings under these specifications.

All of these different surface treatments are conventional in the application of any coating, as in the application of paint to metal, where it is desired to obtain good adherence [R. 168, 550, 885-887, PX-61, R. 1849]. Hall, as a journeyman painter, was long familiar with the desirability of such presurface preparation of metals prior tc painting [R. 646-50].

Not only is this first step of surface irregularization conventional in the prior art, but it is specifically disclosed in a number of prior art patents in the specific art of dry film lubrication.

The prior art patents to Thomson [R. 1616, p. 1, line 112, to p. 2, line 14], Aluminum Colors [R. 1627, p. 2, lines 47-57, 99-106], Work [R. 1642, p. 1, col. 2, lines 52-55], Koch [R. 1684], and Bramberry No. 2,534,406 [R. 1692, col. 4, lines 38-53, col. 9, lines 21-44] all disclose the desirability of irregularizing the surface prior to applying the dry film lubricant coating [R. 239].

The patent to Thomson, No. 1,481,936 [PX-3, R. 1616], which Dr. Burnham discussed by way of example [R. 188] exemplifies a disclosure of this character, wherein the patentee states:

> "Astonishingly adherent graphitic films can thus be applied to paper, tin-foil, lacquer, buffed brass, hand scraped surface plates and highly polished hardened steel, such as needles. Hence, when the application is made upon relatively rougher machined or ground surfaces which, as microscopically viewed, present a vast aggregation of 'hills and valleys' the latter function as graphitic reservoirs and furnish a fresh supply as and when the obtruding 'hills' are elided. These imprisoning 'valleys' may be augmented in depth and area, as by etching, knurling or wire-brushing." [p. 1, line 112, to p. 2, line 14.]

The Trial Court in its opinion, speaking of the Thomson patent, apparently overlooked this portion of the disclosure [R. 59].

(3) Application of Thermosetting Resins Containing Lubricant Solids.

The essence of the alleged invention of Hall, namely the application of a composition including a thermosetting resin containing a lubricant solid, such as graphite or

molybdenum disulphide, was found in the patents of Bergl [R. 1619], McLintock [R. 1623], Stuart [R. 1651], Wilkey [R. 1661], Mahle [R. 1665], Greth [R. 1673], Menking [R. 1686], and both Bramberry patents [R. 1689 and 1692]. Of these only the Bramberry patents were cited by the Patent Office [R. 238-39]. Of these noncited patents, Wilkey, Greth, and Menking were most heavily relied upon by plaintiff to establish the antiquity of this basic inventive advance claimed by Hall. The patents to Bloomenthal [R. 1633] and Wescott [R. 1610] were also cited to establish the prior application of such a thermosetting composition for analogous purposes.

The Wilkey patent No. 2,284,785 [R. 1661], shows the application to a prepared surface of a clutch plate of various compositions containing graphite and molybdenum sulphide in a binder [R. 198-99]. In some cases the composition is applied to reduce frictional wear and in other cases to increase friction [R. 1661, p. 1, col. 2, lines 38-42], the composition in the latter case only, including abrasives such as silica. Several examples of thermosetting resin binders, natural and synthetic, are given by Wilkey.

One example disclosed is phenolformaldehyde resin, which is a thermosetting resin, in a suitable solvent, in which is incorporated graphite and molybdenum sulphide [R. 1661, p. 2, col. 1, lines 37-40, 54-58; R. 197]. This composition is applied to a surface which has been indented or recessed to form minute pockets which act as a reservoir for the materials, and the composition is then baked to set the resin [R. 197]. As stated by Wilkey [R. 1661, p. 1, col. 2, lines 48-52]:

> ". . . This mixture is made into a pasty mass, which is then filled into the pockets until flush with the outer surface of the plate, where it is heated and allowed to harden or set. . . ."

A coating one ten thousandth of an inch thick is formed on the plate [R. 1661, p. 2, col. 1, lines 7-11]. This coating contains the lubricant solid in the polymerized resin [R. 1661, p. 2, col. 1, lines 59-64]:

> "An examination of the glaze produced on the clutch plate from the compositions described above shows that it consists of highly polymerized hydrocarbons which represent the binder, graphite, and molybdenum and sulphur in the proportions of molybdenum sulphide. . . ."

The binder of Wilkey was asserted in the defendant's chart Exhibit W not to include the use of a thermosetting resin. However, on cross-examination defendant's expert, Mr. Crump, admitted that Wilkey did show the use of a thermosetting resinous binder, and that the defendant's notation relative to this patent on the chart was based on the contention that Wilkey did not apply the thermosetting material to the surface, but only into the recesses in the surface [R. 792-93].

The German patent to Greth [PX-3, R. 1672] is very clear in its disclosure of a thermosetting resin binder incorporating graphite, which composition is baked in to provide a lubricating coating [R. 207-14].

The Greth disclosure initially recites the fact that finely divided graphite dispersed in vehicles such as varnishes, wood oil, or synthetic resins to form lubricating coatings has been known, as shown in the German patent to Bergl, No. 466,104 [R. 1673]; that the patentee found that a certain class of phenol or amine condensation resins *"capable of being hardened"* had superior properties for this purpose [R. 1674].

He then enumerates various binders tested, including some thermoplastic and certain thermosetting materials, and finds that a particular lubricating varnish of the invention achieves superior results [R. 1675, 212-14].

This binder is a thermosetting resin, namely a phenol-formaldehyde resole with a plasticizer added. It is described as follows:

> ". . . a plasticized phenol resin, capable of being hardened, which is obtained from a phenol resole, capable of being hardened. . . ." [R. 1675.]

Greth indicates that to 77 parts of this binder, 50 parts of graphite and 22 parts of xylol (solvent) are added to form the composition claimed, which is then baked in at 180° (356° F.) for one hour (as compared with a baking temperature of 350° F. for the phenol-formaldehyde resin in the Hall patent) [R. 1676].

The Greth patent translation [R. 1676] includes an error in German translation of "eingebrannt", which in this context should be translated as "baked in", rather than "burnt in". On this point the witness Dr. Burnham who reads scientific German [R. 122] testified [R. 211]:

> "The Court: Eingebrannt means to burn.
>
> "The Witness: Eingebrannt means to burn but it also may mean baked.
>
> "The Court: It can be used as 'baked in'?
>
> "The Witness: Yes. And 'baked' makes more sense because he indicates a temperature of 180 degrees Centigrade, which is the temperature at which this material *will not burn.* It is thermosetting infusible resin which will withstand this temperature and hence the translation 'baked' is in order.
>
> "The Court: When a translator interprets from a foreign language into the English language they ordinarily do not know the legal terminology and sometimes they translate a word that does violence to the language.
>
> "Mr. Kern: Your Honor, this is probably unnecessary in view of your knowledge of the German

language, but I would just like to ask the witness whether he finds the word 'baked' in the German-English dictionary for chemists.

"The Witness: Under this word in the dictionary, following the translation, 'equivalent translations: burn, calcine, roast, distill, fire, *bake*.'

"The Court: All right."

There was no contrary evidence whatsoever relative to this translation. Nevertheless, the Court in its opinion [R. 61] analyzed this patent around the erroneous translation "burnt in" and came out with the novel theory that, since the resin was employed with a solvent [which is true in all the prior art and the Hall patent as well], there was only an evaporation process here and no "setting" of the resin. According to the Trial Judge, this evaporation is followed by "burning in" to remove the last traces of the solvent from the coating. This discussion of the Greth patent by the Trial Court is highly erroneous from a technical viewpoint, and it is entirely contrary to *all* the evidence in the case, including that of defendant's own experts.

Mr. Crump, defendant's witness, who constantly belittled the prior art patents, nevertheless testified relative to the Greth patent on cross-examination as follows [R. 795-96]:

"Q. (By Mr. Kern): You did find in the Greth patent that a thermosetting resin was employed, did you not? Look at your chart.

"A. Yes.

"Q. That is a thermosetting resin containing graphite particles?

"A. Yes, he included graphite.

"Q. The graphite is applied in the thermosetting resin for the purpose of lubrication?

"A. Yes.

"Q. And he bakes on, does he not?

"A. 180 degrees C.

"Q. Now, in your opinion does the indication of a baking step following the application of a synthetic resin containing graphite provide any indication whatsoever as to whether or not the synthetic resin might be considered thermosetting or thermoplastic?

"A. Well, if he bakes this it would indicate to me that he might have in mind a thermosetting resin."

It is therefore clearly established, with no evidence to the contrary, that the prior art in the dry film lubrication field shows the application of the graphite in a thermosetting resin vehicle followed by baking to set the resin. This is the very essence of the Hall invention as disclosed, claimed, and prosecuted for nine years through the Patent Office.

Another prior art patent clearly showing the use of a thermosetting resinous vehicle containing graphite, which composition is thereafter baked in, is the patent to Menking, No. 2,385,718 [R. 1686].

This disclosure is concerned with a particular article, namely a shuttle, which is coated over that portion of the external surface where wear occurs due to contact with the yarn. The coating is applied to minimize friction resistance and must be adherent under impact [R. 1686, p. 1, col. 2, lines 10-25]. The patentee suggests that, for this purpose, "synthetic resins, particularly the thermosetting resins, such as one of the group consisting of the phenol formaldehyde, urea formaldehyde, melamine formaldehyde, and phenol furfural types, are especially adapted to this use because of their superior resistance to wear, strength, flexibility, and smoothness at operating temperatures" [R. 1686, p. 1, col. 2, lines 27-34].

The patentee then suggests that, with this resin, there may be incorporated graphite to improve the properties of the coating [R. 1686, p. 2, col. 1, lines 17-27], and he claims in claim 7:

> "7. A shuttle comprising a body of magnesic metal and a coating thereon consisting of a mixture of a thermosetting resin and graphite, said coating covering at least a portion of the external surface of said body."

(4) Other Pertinent Prior Art.

The patent to Wescott, No. 1,034,174, issued in 1912 [R. 1610], is the earliest United States patent showing the application of a thermosetting resin containing graphite, which is then cured in place upon the application of heat.

The Wescott patent describes a "Method of Treating Iron or Steel Articles" to form an acid-resistant protective coating on such articles. Wescott employs for his coating composition a vehicle comprising a japan in which is incorporated graphite, which is then baked at 300° F. for one hour and forty minutes [R. 1610, p. 1, lines 29-47; R. 183-84]. This vehicle is a thermosetting resin [R. 184]. The patentee claims:

> "1. The method of treating surfaces of iron or steel, which consists in applying to such surfaces a composition containing noncoalescing electric-furnace graphite and a suitable vehicle, and thereafter baking the article."

This patent does not specifically disclose the use of the coating applied as a lubricant film. Nevertheless, the process employed to achieve the coating, including the essential step of applying a thermosetting vehicle, which is thereafter cured or set on the metal article, is clearly disclosed. Thus, although Mr. Robert Burns strenuously

argued at a later date on his own application that Wescott did not show a process for making a lubricating finish and therefore was not anticipatory [R. 1774, 1784], the Examiner repeatedly held that the Burns process was unpatentable thereover.

In the prosecution of the Hall patent in suit, however, ten years later, the Wescott reference was never cited [PX-2, 2-A, 2-B].

The prior art literature cited by plaintiffs includes an article appearing in the German text of 1943 by Englisch [PX-12, R. 1709], which constitutes a disclosure of the application of a synthetic varnish binder containing graphite to a roughened surface followed by baking [R. 1711]. This process achieves "high adhesiveness" of the film, "resistance to abrasion", and "insolubility in lubricating oil and liquid fuels" [R. 1710].

Such process as described would constitute to anyone skilled in the art a disclosure of the use of a thermosetting resin binder, by Mr. Crump's own admission that the baking step following the application of the synthetic resin indicates a thermosetting resin [R. 796].

The National Advisory Committee Technical Note No. 1578 [PX-14, R. 1711] indicates the knowledge in the art, prior to 1950, of the superiority of molybdenum disulphide as a lubricating solid over graphite [R. 1714].

(5) The Bramberry Patents Nos. 2,470,136 and 2,534,406.

These patents were copending and may be considered together, as they incorporate by reference in each the specification of the other and disclose a combination of all of the steps of the Hall patent in suit.

Bamberry No. 2,470,136 teaches a process for applying the metallic surfaces, such as engine cylinders, pistons, and piston rings, a coating of solid lubricant material,

namely graphite, tenaciously bonded to the surface of the metal [R. 1689, col. 1, lines 1-17; R. 219]. The coating composition consists of a resin binder with solid lubricant particles and phosphoric acid dispersed therein [R. 219]. The binder used is described as follows [R. 1689, col. 2, lines 45-49]:

> "In the above formula, the binder is preferably a resin and may be of the class of petroleum or vegetable residue pitches, it being understood, however, that any suitable binder may be employed."

The ratio of graphite to binder specified is in the range of from 3 to 1 to 2 to 1 [R. 1689, col. 3, lines 66-68].

In applying this composition the patentee first prepares the surface in accordance with the method described in the copending 2,534,406 patent [R. 1689, col. 5, lines 53-57] by cross-hatched honing to provide recessed scratches of a depth of .0002" [R. 1692, col. 4, lines 37-43; col. 9, lines 11-20], which provides a large number of microscopic recesses or irregularities in the surface [R. 223, 225]. Another method of irregularization, by electrolytic etching of chromium surfaces, is also specified [R. 1692, col. 9, lines 21-31].

After this initial surface preparation, Bramberry sprays the surface with the liquid containing the resinous binder with the graphite and phosphoric acid dispersed therein, air dries, and then bakes the film at from 400° to 600° F. [R. 1689, col. 4, lines 39-50; R. 221-22] to harden the film. The film thickness is from three ten thousandths to one one thousandth of an inch thick [R. 1689, col. 4, lines 57-58; R. 222].

The phosphoric acid present in the composition of Bramberry reacts with the base metal to form a phosphate on the metal, and the resin binder with the graphite in it is bonded to that surface [R. 335]. As a result, the Bramberry surface is also irregularized in the same manner as indicated in the Hall application, where phosphating is employed for surface preparation [R. 332, 1689, col. 5, lines 20-27].

The argument of defendant that the phosphoric acid in Bramberry's composition, rather than the binder, serves to bond the graphite to the metal surface represents an impossible situation, since the phosphate crystals can form only on the surface of the metal where the acid contacts the metal [R. 884-85]. Thus the addition of the phosphoric acid in Bramberry merely accomplishes in one step what Hall effected by two separate steps. As indicated by Dr. Burnham [R. 882]:

> "Q. Now, referring to the Bramberry patents, could you tell me in your opinion what difference there is between the preparation of the surface in Bramberry, as compared to the preparation of the surface in the Hall process, where phosphating is the first step in the Hall process?
>
> "A. Well, I think the main difference is that Bramberry does essentially in one step what Hall does in two steps, namely, in the Hall there is a phosphating step first, prior to the application of the lubricant. In the Bramberry case the phosphate and the binder—I mean, and the lubricant film are applied at the same time, in the same step.
>
> "Q. Does Bramberry perform a phosphate coating at the surface of the metal or elsewhere?
>
> "A. At the surface of the metal, yes."

The primary basis of distinction of the Hall process over Bramberry asserted by defendant was the resin binder. It was on this alleged basis of distinction, so strenuously urged in the Patent Office by defendant's employee Crump, that the Hall application was finally allowed in the Patent Office.

Accordingly, at the trial Mr. Crump asserted unequivocally that the class of resins, namely vegetable and petroleum residue pitches, taught by Bramberry was not thermosetting in character [R. 750]. In view of his affidavit submitted to the Patent Office during the prosecution of the case, Mr. Crump could hardly take a different position as an employee of defendant at the trial.

However, Mr. Bush, who testified as a chemical expert for defendant, did *not* exclude thermosetting resins from this general class of resins specified by Bramberry [R. 827-50].

Defendant's third witness, who testified relative to the Bramberry patents, over plaintiff's objection on this occasion, was the patentee Hall. He admitted on cross-examination that asphalt (a petroleum residue pitch) hardened upon heating and "set" [R. 681-82].

He also characterized the asphalt as a *thermosetting* pitch which upon initial softening flowed into the irregularized surface formed by the reaction of the phosphoric acid with the metal in the Bramberry process [R. 682].

The testimony of Dr. Burnham and Dr. Dawe, both highly qualified chemists, indicates that the class of resins specified by Bramberry for his binder included thermosetting resins [R. 220, 1227-28]. Both of these witnesses

performed tests and cited authorities to establish the fact that, when heated to polymerization temperature, certain of these resins, both vegetable and petroleum residue types, became hard and insoluble and, when thereafter heated, do not resoften [R. 1313-14, 1318-19, 220, 287, 873].

The fact that asphalt coated on a metal plate and heated to 600° F. is not thereafter soluble in toluene, the original solvent in which it was thinned, was demonstrated by Dr. Burnham in the court room [R. 875]. Nor does the asphalt, once heated in the film to this temperature, soften on reheating [R. 875]. The addition of graphite to the asphalt cannot, as suggested by Mr. Crump, affect this thermosetting action by preventing the oxygen of the air from entering into the reaction, since graphite does not take up oxygen from the air until it is heated to a much higher temperature than 600° F. [R. 876-79].

Bramberry indicates that he bakes in those instances where a particularly hard adherent film is desired [R. 1689, col. 5, lines 13-19].

This is indicative of the intention to employ a heat hardenable or thermosetting resin [R. 228-29]. Moreover, in Bramberry No. 2,534,408 [R. 1703, col. 5, lines 12-26], which is a continuation-in-part of the '406 Bramberry patent, the patentee, after describing the use of a thermosetting resin binder of phenolformaldehyde resin, which is baked at 350° F. to 500° F., indicates that this binder, "as well as those described in my co-pending applications Serial Nos. 555,377 and 555,378 now Patent #2,470,136 . . . are insoluble in water and usual lubricating oils and are

resistant to heat and the chemical action of combustion and of detergent oils."

So Bramberry himself ascribes to the binders of the '136 and '406 patents the properties of infusibility and insolubility which also characterize the synthetic thermosetting resin employed in the later Bramberry patent.

It thus appears that all of the evidence, both by demonstrated tests and oral testimony of the experts (with the sole exception of Mr. Crump), as well as the patentee, establishes that Bramberry's disclosure of "any suitable binder", "preferably a resin" which "may be of the class of petroleum or vegetable residue pitches" which is baked to harden the resin, encompasses the disclosure of thermosetting resins.

(h) The File Wrapper Affidavits Re Bramberry Patents.

The question naturally arises why, in view of the disclosures of the aforesaid Bramberry patents, the Patent Office issued the Hall patent in suit. The answer is found in the file wrapper affidavits of Silversher and Crump, in which it was asserted first that Bramberry's disclosure did not embrace the use of a thermosetting resin [PX-2-A, pp. 63-66; PX-2-B, pp. 38-51 (Appendix)], and secondly that Bramberry's thermoplastic resin did not achieve the results obtained with Hall's thermosetting resin as shown in test results set forth. On the basis of these arguments and numerous interviews, the Patent Office was finally prevailed upon to issue the Hall patent.

On examination of the facts alleged in these affidavits, however, the witnesses Dr. Dawe and Dr. Burnham both

pointed out that the reasons given by Crump in support of the argument that Bramberry disclosed only thermoplastic resins were technically erroneous, and that the tests performed were not scientifically capable of proving the results claimed [R. 232-38, 1233-39, 1247-48].

The affiant Silversher, over stern warning from the Trial Judge, admitted that he had erred in his affidavit, and that his tests did not in fact establish the claimed superiority of the Hall resin over that of Bramberry [R. 387-90]. The defendant did not present any evidence to the contrary. Nor did Mr. Crump, who was present at Dr. Dawe's testimony long prior to the trial of this action, ever attempt to rebut Dr. Dawe's testimony attacking the veracity of Crump's file wrapper affidavit and his "stacked" tests.

The contentions regarding the disclosure of Bramberry in the affidavits of both Silversher and Crump were followed by tests which were supposed to compare the *resins* employed by Hall and Bramberry. These tests were designed to show that the alleged thermoplastic resin of Bramberry was inferior in wear to the thermosetting resin of Hall [PX-2-A, pp. 64-65; PX-2-B, pp. 42-46 (Appendix)]. The tests, however, made no such comparison, because the lubricating solid used in connection with the test of the Hall resin was primarily molybdenum disulphide, which was known to be a far better lubricating material than the graphite employed in the comparative test of the Bramberry resin. Therefore, the tests set forth in the affidavits were fundamentally and basically meaningless from a technical point of view and could not possibly establish the superiority of Hall's

resin over that of Bramberry [R. 233-36, 1237-38, 418]. As stated by Mr. Silversher in respect of his own affidavit [R. 395]:

> "Q. (By Mr. Kern): Is it possible that a more impartial result from a technical point of view would have been secured from your tests if you had used the same lubricating solid in both resins?
>
> "A. Yes, it would have been.
>
> "Q. In your present opinion, is the affidavit which was submitted to the Patent Office, appearing on pages 63 to 65 technically sound?
>
> "A. No, it was not."

The failure to test the Bramberry resin in a coating containing graphite as against the Hall resin using *graphite* in the coating was due to the fact that the Hall composition, using graphite as a solid lubricant, would not operate within the minimum requirements specified in the affidavits of Silversher and Crump [R. 388].

In addition, in the tests performed by Mr. Crump, he selected a roofing asphalt for the Bramberry resin, which was obviously the poorest performing example he could have chosen in the field of petroleum residue pitches. He makes no mention of baking this coating whatsoever, despite the fact that Bramberry indicated baking at 400° to 600° F. when a hard coating was desired [PX-2-B, pp. 43-44, appendix]. In the Hall composition he failed to follow the Hall patent disclosure, but employed the best running commercial composition known, which did not include the components which Hall specified, but instead included polyvinyl butyrol and two to five per cent of an elastomeric resin [PX-2-B, p. 45; R. 237-38, 1238-39].

The Crump comparative tests were thus "stacked" tests wherein the Bramberry composition coating and process were predesigned not to work, and the Hall coating went beyond the Hall patent disclosure in order to insure good performance.

(i) Comparative Wear Tests of Hall v. Bramberry.

In order to establish the comparative wear properties and permanence of the Hall and Bramberry lubricating coatings, tests were separately conducted by Dr. Dawe and by J. DeDapper of Redel, Incorporated, a research testing laboratory [R. 409], using the same lubricating solids, molybdenum disulphide or graphite in each of the respective resins compared. Both of the witnesses Dawe and DeDapper described their test conditions and procedures in detail and submitted for inspection their test races on which the coatings were deposited [R. 1239-47; PX-43-B; R. 1759, 418-23; PX-23; R. 1719-25].

Dr. Dawe concluded, as a result of his tests, as follows [R. 1247]:

> "A. It appears to me that the Crump tests do not make an adequate comparison of the two binder systems and that the evidence that Crump gives does not substantiate the fact that the Bramberry binder is inadequate and it is thermoplastic.
>
> "Q. (By Mr. Kern): What do your own tests show?
>
> "A. Our tests show that *if you used the same lubricating solid in each of the two systems you get comparable results.*"

Mr. DeDapper reached a like conclusion—namely that, if you compared all graphite coatings of Hall and Bram-

berry, a similar wear life was achieved with either binder system. Likewise, if one employs ninety per cent molybdenum disulphide in lieu of the graphite in the Bramberry system, results are achieved in the neighborhood of fifty or sixty hours of wear life on the Hartman tester, which is consistent with the required times suggested by Mr. Crump in his affidavit as being commercially acceptable [R. 423-26; PX-23, R. 1724].

Defendants made no effort at the trial to establish that the Hall binder system achieved superior results to the binder of Bramberry, which Mr. Crump had alleged was thermoplastic and would therefore not work. *No tests or other evidence was ever offered or ever submitted by defendant comparing the two binder systems using graphite in both the Hall and Bramberry systems as the lubricating solid.*

The tests of DeDapper actually compared all-graphite coatings applied by a licensee under the patent in suit (Electrofilm Coating No. 4006) with an all-graphite Bramberry coating [PX-23, R. 1723; PX-30, R. 1726, 562-63]. Defendant sought to attack this comparison only on the ground that its all-graphite coating No. 4006 was not intended as a lubricating coating and by cross-examination on the procedure used by these witnesses, Dawe and DeDapper [R. 430-62, 1248-1311]. Defendant did not offer any comparative tests itself using the same lubricating solid in both films. The record is therefore silent as to any alleged new or improved results obtained from the use of the thermosetting resin of Hall over the resins disclosed by Bramberry.

Accordingly, the Trial Court made no finding of fact as to any new or improved results accruing from the combination of steps claimed in the Hall patent in suit.

IV.
ARGUMENT.

POINT 1.

Findings of Fact Nos. 9 Through 15 Relating to Prior Knowledge or Use, Prior Public Use and Prior Invention Are Supported by Substantial Evidence and Are Not Erroneous.

(a) Introduction.

The defendant attacks Findings 9 through 15 of the Trial Court basing such attack on the alleged error in admitting five particular exhibits into evidence, contending that the findings would not be supported by the evidence if the evidence claimed to be inadmissible were stricken (Appellant's Opening Brief, p. 28). While it is plaintiff's contention, as will be discussed *infra,* that each exhibit was properly admitted, the prior invention, prior knowledge and use, and prior public use of the process described and claimed in the Hall patent as set out in the findings are each established by clear, strong and convincing evidence even without reliance upon the particular exhibits objected to by defendant.

(b) Finding No. 9.

In this finding the Court held:

> "The process disclosed and claimed in the Hall patent in suit was known and used by Acheson Colloids Company and various of the officers and employees of that company, who reduced the said process to practice and participated in such reduction to practice by customers of Acheson Colloids Company long prior to April 13, 1946, in connection with the application, in accordance with the essential steps of the Hall process, of the Acheson products 'Varnodag' and 'dag' dispersions Nos. 35, 38, and 47, said com-

positions each comprising graphite in a thermosetting resin, and Acheson Colloids Company has, since at least as early as 1941, sold various of said compositions with directions to apply them in a manner similar to the method described and claimed in the Hall patent, which has been done by its customers."

The process disclosed and claimed in the Hall patent in suit was known at Acheson by Mr. Reynolds, Mr. Crankshaw, Mr. Buck, and Dr. Dawe and was successfully tested at Acheson long prior to April 13, 1946. Mr. Buck practiced the process by applying Varnodag, a thermosetting phenolformaldehyde resin containing graphite, and testing the coatings [R. 1187-90]. Mr. Reynolds acquired knowledge of the application of Varnodag in accordance with the process of the patent in suit in 1940 through the tests of his subordinate Mr. Heer [R. 1058-68]. This evidence in itself is sufficient to invalidate the patent in suit under 35 U.S.C. Section 102(a) without reliance on any acts performed by Acheson customers.

The basic Supreme Court case under this section, *Corona Cord Tire Co. v. Dovan Chemical Corp.*, 276 U. S. 358, 72 L. Ed. 610, 48 S. Ct. 380 (1928), clearly establishes that performance tests of this type which were carried out on the Acheson products constitute the requisite reduction to practice of the process. The *Corona* case holds [276 U. S., at 384] that a successful carrying out of the invention in the laboratory is sufficient to establish prior knowledge and use without regard to commercial use.

In the present case, the evidence is much stronger, since Varnodag, as well as Dag 35, 38, and 47, was later placed in production and sold for use in the process [R. 1045, 1152]. This knowledge and use at Acheson is not only established by the uncontradicted testimony of three witnesses, but is also corroborated by documentary evidence,

particularly the Technical Bulletins of 1934 and 1941 [PX-40-B, 40-E], and the Heer memorandum [PX-40-F] discussed below.

The testimony of the Acheson witnesses Reynolds and Crankshaw also clearly establishes their knowledge of the use of the process of the Hall patent by customers of Acheson who applied Dag dispersions 35, 38 and 47 prior to April 13, 1946. These three dispersions were developed by Dr. Dawe in 1941-1942 and were each thermosetting resins containing graphite. This is established, without controversy, by Dr. Dawe's testimony and laboratory notebook in evidence [PX-43-A, R. 1219-20]. This notebook, plus the oral testimony, corresponds to the evidence held sufficient in the *Corona* case to establish that the patentee was not the first discoverer of the patented invention. See also to the same effect *Rosaire v. Baroid Sales Division, National Lead Co.,* 218 F. 2d 72 (C. A. 5, 1955).

It should be noted that 35 U.S.C., Section 102(a) specifies that prior knowledge *or* use will bar issuance of a valid patent. Here it is established by very clear and convincing evidence that the process was reduced to practice by such customers in their use of the Acheson compositions developed and sold to them by Acheson. Acheson personnel were concerned with the use of their own products and in a technical and consulting capacity aided their customers in using the products and thus performing the process. There is no requirement in the law, as defendant appears to intimate [Brief, p. 28], that the prior knowledge of a process be derived from the personal reduction to practice by the party or parties having such knowledge.

Both Mr. Reynolds and Mr. Crankshaw testified to having observed the performance of the process of the Hall patent in the plants of a number of their customers

using Dag dispersions 35, 38 and 47, and the processes at two plants were described in detail step by step [R. 1090-92, 1134, 1152-64]. This testimony is not hearsay, as alleged in defendant's opening brief [p. 28]; it is testimony by technically trained percipient witnesses of operations which they personally observed. While Mr. Reynolds testified that Aquadag was used at Process Engineering, as indicated in appellant's brief [p. 28], he also testified that Dag dispersions 35, 38 and 47 comprising graphite in thermosetting resins were on other occasions used at Process Engineering [R. 1141-42].

(1) Admissibility of Documents Supporting Finding No. 9.

The above evidence relative to the knowledge and use of Varnodag is *corroborated* by the report of Mr. Heer [PX-40-F, R. 1741] which sets out the process of application by Acheson to parts supplied by General Electric Appliance Company. The knowledge and use resulting from the application by its customers of Acheson dispersions Dag 35, 38, and 47 is *corroborated* by the group of cards from the Priority File of that company [PX-40-G, R. 1742 *et seq.*] which are summaries from sales reports covering the application of these dispersions. These are two of the five exhibits to which defendant objects.

With respect to the authenticity of the Heer report, Exhibit 40-F, Mr. Reynolds first testified to the discussions with Mr. Heer concerning the problem of the General Electric Company and the approach to its solution to be taken by Acheson. He identified the document in which Mr. Heer reported on this matter to Mr. Reynolds, and also identified Mr. Heer's signature thereto. Mr. Reynolds testified to the regular course of business of Acheson in preparing and retaining these reports. The reports were regularly prepared by salesmen working under Mr. Reynolds; the originals of the reports were

sent to the company files and signed carbon copies were sent to Mr. Reynolds, who retained them in a file in his office for use primarily in preparation of comprehensive sales treatises. This exhibit is a record made as a memorandum of an act in the regular course of business of Acheson and it was the regular course of such business to make such records [R. 1058-68]. The requirements of 28 U.S.C., Section 1732(a) as discussed by this Court in *C. S. Johnson Company v. Stromberg,* 242 F. 2d 793, 798 (1957) are fully met.

As indicated by the Trial Court, and as set out in the statute, all other circumstances of the making of the record go to its *weight* but not its *admissibility.*

The requirements set out in the case of *William Whitman Co. v. Universal Oil Products Co.,* 125 Fed. Supp. 137 (D. C. Del., 1954), relied upon by defendant [Brief, p. 30], are also met in this exhibit. Here we have a witness, the addressee of the report, testifying to the authenticity of the exhibit and, also signatures of the writer for comparison. In the *Whitman* case, the Court specifically stated that "no witness testified to the authenticity of the exhibits" (p. 145) and, therefore, refused to consider the exhibits.

United States v. DuPont, 126 Fed. Supp. 27 (N. D. Ill. E. D., 1954) also relied upon by defendant, [Brief, p. 30] is concerned with the general rule of hearsay declarations relative to testimony of a witness as to what a third person told him as evidence of the facts asserted. This is not pertinent to the present case, wherein Mr. Reynolds is testifying as to his personal knowledge relative to the General Electric problem in his discussions with Mr. Heer, the document being offered as corroboration of such knowledge. *United States v. Smart,* 87 F. 2d 1 (C. C. A. 5, 1936) [Brief, p. 30] is concerned with the general hearsay rule without reference to 28 U.S.C., Section 1732

and is not pertinent to the present action. In *Teter v. Kearby,* 169 F. 2d 808 (C. C. P. A., 1948) [Brief, p. 30], the Court of Customs and Patent Appeals indicated that the appellant's reports relied upon to corroborate appellant's testimony did not in themselves identify the composition of the catalysts used in the runs (p. 816). In contrast, Plaintiff's Exhibit 40-F completely identifies both the materials and the process involved.

The use of Acheson dispersions 35, 38 and 47 in the performance of the Hall process as observed by Mr. Reynolds and Mr. Crankshaw was corroborated by Plaintiff's Exhibit 40-G [R. 1742 *et seq.*] consisting of thirteen cards selected from a file maintained at Acheson. Mr. Reynolds testified that salesmen under his supervision made reports to him covering their activities at the plants of the customers they called upon. These reports were made in the regular course of the business of Acheson and were reviewed upon receipt by Mr. Reynolds. During World War II, Acheson, like many other manufacturers, had problems with material priorities and, therefore, Mr. Reynolds had certain of his employees prepare a card file covering the use of Acheson products by those of its customers whom Acheson felt would be able to supply priority ratings. This card file was prepared and maintained in the regular course of business by personnel under Mr. Reynolds' supervision who abstracted the material on the cards from the aforesaid salesmen's reports [R. 1075-76, 1116-22]. No entries were made in this priority file after the war but the file was retained because it provided a list of customers using Acheson products [R. 1120]. On cross-examination Mr. Reynolds selected card 71 [R. 1746] as one which he had a specific distinct recollection of referring to in the period 1940 to 1946 [R. 1123-1124] and also referred to the file a year or two ago to look up a use of material [R. 1123]. It is clear that these cards are records made as memo-

randa of events in the regular course of the Acheson business, it being the regular course of business to make such records within a reasonable time after the occurrence of the event. The discussion of the law with respect to Exhibit 40-F, *supra,* is equally applicable to Exhibit 40-G, which also was properly admitted.

Defendants also complain that while depositions were being taken at Acheson, counsel for defendant requested of Mr. Sprague, Secretary of Acheson, permission to take his deposition at that time. Mr. Sprague declined, stating, "I am afraid not, unless I have my own counsel" [R. 1320]. No notice of deposition of Mr. Sprague was ever given and no subpoena for his appearance was ever sought by defendant. Certainly this failure of defendant to pursue this matter in the five months elapsing between the Acheson depositions and the trial of this action cannot now be used to attack the authenticity of plaintiff's exhibits. Defendant had ample time to establish any facts it thought helpful to its position. Its failure to further pursue this matter should in itself be indicative of the authenticity of the documents in question.

(c) Finding No. 10.

In this Finding the Court held:

> "The process disclosed and claimed in the Hall patent in suit was known and used at Bell Telephone Laboratories, Inc., in New Jersey prior to the earliest date of invention claimed by the patentee, Hall, in connection with the application of dry film lubricating compositions comprising graphite in a thermosetting resin, which compositions were developed by Robert Burns, Wilfred E. Campbell, and others and successfully applied in accordance with the essential steps of the Hall process at Bell Telephone Laboratories, Inc., in 1934-1935."

It is clearly established that Mr. Burns developed, tested and reduced the "Burns process" to practice, and that Dr. Campbell developed, tested and reduced the "Campbell process" to practice and also carried out and tested the Burns process in 1934-1935. These facts are not contradicted and each in itself is sufficient to invalidate the patent in suit for prior knowledge and use under 35 U.S.C., Section 102(a) and the *Corona* case, *supra.*

The Burns process, as exemplified in his application for patent [PX-44-A, R. 1761 *et seq.*], and Bell Telephone Laboratories specification LRM-2064, Issue 1, Baked Lubricating Finish No. 495 Finish [PX-44-B, R. 1788 *et seq.*] and by Burns' own tests thereof [R. 1348-50] includes treating the surface of the element to form a large number of substantially microscopic irregularities, as by scratch brushing, sandpapering, or zinc electroplating, applying to the irregularized surface an abrasive-free coating mixture consisting of liquid and a large number of finely divided solid lubricant particles, such as graphite, with the liquid including an uncured thermosetting polymerizable resin bonding agent, such as black japan, and baking the coating to polymerize and harden the thermosetting resin. This is the process described and claimed in the Hall patent.

Contrary to defendant's argument [Brief, pp. 25, 27], the Burns process included the surface irregularization step [R. 1348, LRM-2064, Issue 1, R. 1788], and in fact the primary distinction urged by defendant in the Burns process over the Hall process was in the resins employed. Defendant contends that Burns did not use a thermosetting resin [Brief, pp. 25, 27, 34]. In this respect, however, the weight of the evidence establishes the fact that black japan contains thermosetting resins and can be hardened by baking to tightly bond the solid lubricant particles in place on the roughened surface.

Even if we assume *arguendo* that black japan, as a matter of strict terminology, is not properly described as a thermosetting resin, it nevertheless admittedly polymerizes to form three-dimensional cross-linkages which impart to the film the properties of thermosetting resins, namely, hardness, infusibility, and insolubility [R. 146-48, 833, 879-82, 1334]. So regardless of definition of a thermosetting resin, the identical chemical phenomenon occurs in the setting of the black japan, and the identical result is achieved, namely, a hard, infusible, insoluble film. Thus, as found by the Court in Finding No. 15, there is no invention in the patent in suit over the Burns process. *Pierce v. Muehleisen,* 226 F. 2d 200 (C. A. 9, 1955).

It will be recalled that in the Campbell process Beckosol was substituted for the black japan of the Burns process, and the composition containing Beckosol was tested by Campbell against the Burns composition and subsequently was specified by Bell Telephone, both for baking at elevated temperatures and setting at room temperature in the Western Electric process. The evidence that Beckosol is a thermosetting resin is not contradicted. Therefore, it is clear that the process disclosed and claimed in the Hall patent was also known and used at Bell Telephone Laboratories by Dr. Campbell and his associates long prior to Hall's alleged invention thereof.

Defendant's primary argument relative to the Campbell knowledge and use appears to be that Campbell's tests were "experimental" and therefore did not constitute a reduction to practice [Brief, p. 32]. This argument is utterly without foundation, since reduction to practice is not negatived by virtue of the experimental nature of the tests, and indeed defendant has cited no authority in support of its argument.

On the other hand, it is well established that successful laboratory testing (which by its very nature is experimental) constitutes a reduction to practice, irrespective of commercial use thereafter. See *Corona v. Dovan, supra,* and the citations of the Trial Court on this point [R. 68].

(d) Findings Nos. 11 and 12.

In these Findings the Trial Court stated:

> 11. "The process disclosed and claimed in the Hall patent in suit was in public use in this country more than one year prior to the earliest filing date of the application for the patent in suit."
>
> 12. "The process disclosed and claimed in the Hall patent in suit has been in public, open, and continuous use at Western Electric Company, Inc., Chicago, Illinois, from at least as early as 1938, to the present date, in connection with the application of the dry film lubricating compositions developed and tested at Bell Telephone Laboratories, Inc., such compositions being applied during said period to large quantities of telephone parts in accordance with the essential steps of the Hall process, for the purpose of providing a durable dry film lubricant coating on rubbing surfaces thereof."

Both the Burns process and the Campbell process have been in public, open and continuous use at the Western Electric plant in Chicago. The Burns process, identified as Baked Lubricating Finish No. 495, was in use between 1936 and 1943. This is established by the testimony of Dr. Wagner, Mr. Brown, Mr. Thovsen, Plaintiff's Exhibits 44-B, 47-A, 47-J, 47-L (specifications for 495 finish), and Exhibits 46-A through 46-F, 47-I, 47-K (correspondence *re* establishment of specifications). The Campbell process has been in use from 1938 to the present

being identified as Lubricating Finish, Air Dried No. 517, and later as Lubricating Finish, Baked No. 495. This is established by the testimony of Dr. Wagner, Mr. Brown, Dr. Campbell, as well as Plaintiff's Exhibits 45-A, 45-B (specifications) and Exhibits 47-B and 47-C (correspondence).

This testimony was further corroborated by three Western Electric working drawings, Plaintiff's Exhibits 47-D, 47-E, and 47-F [R. 1818, 1820, 1822]. These drawings have previously been analyzed in detail under the Statement of the Case, *supra,* and support the showing that the Burns process and both versions of the Campbell process were in public use prior to the earliest date of invention alleged by Hall.

The three Exhibits 47-D, 47-E and 47-F, which defendant has objected to admitting into evidence, *are prints of original tracings.* The testimony establishes that the tracings are working drawings of the Western Electric Company which are made in the regular course of its business. The prints were made in the company's blueprint room where the tracings are kept, at Dr. Wagner's request, the prints being prepared by Western Electric personnel and forwarded to Dr. Wagner. *The tracings were produced at the depositions for comparison with the prints* and were obtained from the files at Dr. Wagner's request by company personnel under his supervision. Dr. Wagner identified the tracings and prints as being made and used in the regular course of business of the Western Electric Company [R. 1492-1501, 1506-11]. The present situation is exactly that covered by the ruling of this Court in *C. S. Johnson Co. v. Stromberg,* 242 F. 2d 793 (1957). In this recent case, a witness identified drawings taken from his company's files, which drawings were customarily kept therein (p. 796). A witness also identified the structures shown on a num-

ber of the drawings (p. 796). The Court held that it was not necessary "to produce some one working at the business when the documents were made to identify them, and testify that they were then made 'in the regular course of business'" (p. 799) and held that there was sufficient foundation laid for the admission of the drawings.

(e) Finding No. 13.

This Finding states:

> "Said dry film lubrication method in public use at Western Electric Company, Inc., Chicago, Illinois, was practiced in accordance with the specifications issued by Bell Telephone Laboratories, Inc., and by Western Electric Company, Inc., which specifications described the surface preparation, the materials applied, and the subsequent baking, covering the essential steps of the Hall process of the patent in suit."

The specifications speak for themselves [PX-44-B, 45-A, 45-B, 47-A, 47-J, 47-L, R. 1788, 1793, 1800, 1812, 1828, 1833]. Dr. Wagner and Mr. Brown, both of whom held supervisory positions in the organic finishing department, testified that the Western Electric operations were carried out in accordance with these specifications [R. 1469-77]. Furthermore, Dr. Wagner, Mr. Brown and Dr. Campbell testified to their personal observations of the practice of the process in the Western Electric Plant, and Mr. Thovsen to personally performing the process as set out in the specifications.

Defendant's argument that Mr. Burns felt that surface preparation was necessary only to clean the surfaces is not relevant, since the evidence clearly establishes that the surfaces actually were irregularized prior to application of the coating material. All of the parts handled in production at Western Electric were either zinc plated

or acid etched by the bright dip process. It was established at the trial by physical demonstrations under a microscope that both these treatments provide microscopic irregularities over the entire surface of the part. Thus the fact that Mr. Burns did not feel that a step in the process performed at Western Electric was necessary, does not derogate from the fact that it was actually included in the method used, as is set forth in the specifications.

(f) Finding No. 14.

Finding No. 14 states:

> "Before the invention by the patentee of the process disclosed and claimed in the Hall patent in suit, the said invention was made by Robert Burns of Bell Telephone Laboratories, Inc., who filed application for letters patent therefor on March 26, 1936; said application was rejected on the prior art, but the invention of Robert Burns was never abandoned, suppressed, or concealed, but was thereafter in modified form extensively employed at Western Electric Company, Inc."

The Burns process anticipates the process disclosed and claimed in the Hall patent in suit. This has been discussed *supra* in connection with Findings 10-13, as well as in the Statement of the Case and will not be repeated here. The evidence that the Burns process was invented by Mr. Burns prior to March 26, 1936 and was never abandoned, suppressed or concealed but was incorporated in the Bell Telephone Laboratory specification LRM-2064, Issue 1, and used openly at Western Electric is not contradicted. Therefore invalidity under 35 U.S.C., Section 102(g) is also established.

The abandonment of an application for patent does not constitute an abandonment of the invention itself,

and the abandoned application is evidence of the prior invention, *i.e.,* conception and reduction to practice, of the process of the application by the applicant. See, *Smith v. Hall,* 301 U. S. 216, 227, 81 L. Ed. 1049, 1057 (1937); *U. S. Blind Stitch Mach. Corp. v. Reliable Mach. Works,* 67 F. 2d 327, 328 (C. C. A. 2, 1933); *United Chromium v. General Motors Corp.,* 85 F. 2d 577, 579 (C. C. A. 2, 1936).

(g) Finding No. 15.

Under Finding 15 [R. 93] the Trial Court characterized the evidence presented in this case relative to prior knowledge and use, prior public use, and prior invention as "clear, strong, convincing, and uncontradicted" and also found that there is no invention in the patent in suit over such prior art. The evidence relative to prior knowledge and use, public use, and invention has been set out in detail in the Statement of the Case and the arguments relating to Findings 9-14, and the finding of lack of invention over this prior art has not been specifically controverted in appellant's brief [p. 27].

Defendant's primary contention relative to this evidence appears to be that oral testimony is not sufficient [Brief, p. 31], which is not in accord with contemporary rulings of this Court: *Whiteman v. Mathews,* 216 F. 2d 712, 716 (1954); *C. S. Johnson Company v. Stromberg,* 242 F. 2d 793, 795 (1957). See also: *Borkland v. Peterson,* 244 F. 2d 501, 503 (C. A. 7, 1957).

Accordingly, it is submitted that each of Findings 9 through 15 is proper and should be affirmed.

POINT 2.

The Essence of the Alleged Invention of the Hall Patent in Suit Is Anticipated by Prior Art Patents Which Were Not Cited by the Patent Office.

The prosecution of the Hall patent in suit was long and persistent, involving over nine years in the Patent Office and including five Office interviews and the submission of affidavits on three occasions to distinguish over the prior art. It was conducted as a process of wearing down a series of examiners, or, as stated by the Second Circuit in *Gentzel v. Manning, Maxwell & Moore, Inc.*, 230 F. 2d 341, at 345 (1956):

> ". . . Of at least equal persuasiveness are the tortuous progress of these patents through the Patent Office from 1935 to 1942 and the many emendations of statement, especially in the second patent, made to meet the objections of examiners—a classic example of what Judge Learned Hand has called 'the ant-like persistency of solicitors' which overcomes 'the patience of examiners, and there is apparently always but one outcome.'"

Throughout most of this entire prosecution of the Hall applications, defendant contended that the gist of the invention claimed was the use of a thermosetting resin. The prior art was distinguished on the basis of the failure of the prior art patentees to teach the use of a thermosetting resin which would set up to a hard and infusible condition. The argument which finally resulted in the allowance strongly urged that invention resided in the use of a thermosetting resin over the alleged thermoplastic resin of Bramberry and the other prior art cited [PX-2-B, p. 46, Appendix].

During this entire prosecution, none of the patents in this art showing the use of such thermosetting vehicles was cited except the Bramberry patents. Bramberry's

teachings were avoided by means of the Crump and Silversher affidavits which induced the Patent Office to accept an erroneous technical interpretation thereof. Neither the Greth, Wilkey, nor Menking patent showing the application of thermosetting resinous binders containing graphite or molybdenum disulphide was ever cited, and there is no presumption of validity of the Hall patent over this most pertinent art. *Jacuzzi Bros., Inc. v. Berkeley Pump Co.,* 191 F. 2d 632, at 634 (C. A. 9, 1951).

Defendant, during the trial, admitted that the Greth patent shows this essential step, namely, the application of a thermosetting resin with solid lubricant particles dispersed therein, which is subsequently baked in to set the resin [R. 795-97, DX-W].

Mr. Bush, defendant's chemical expert, specifically adopted Mr. Crump's testimony at the trial on the teachings of this and the other patents cited [R. 831], and there was and is no factual question to be determined respecting the prior art disclosure by Greth of such use of thermosetting resins.

Even though the Greth patent is in the German art (which may account for the Patent Office overlooking same), it alone negatives any invention in the Hall patent, since it anticipates that step which constitutes the alleged advance in the art for which the patent was granted. The essence of the alleged inventive concept of Hall [R. 170-71] is clearly shown in the Greth patent alone.

That a foreign patent teaching the essence of the alleged invention does not also disclose a structure or process identical in each detail to that of the patent in suit does not preclude its anticipation thereof (*Gratiot v. Farr,* 237 F. 2d 940, 942 [C. A. 9, 1956] [Cert. denied 352 U. S. 1026]). The fact that Greth takes for granted the conventional step of surface preparation as shown in

the earlier German art in this field [Becker, R. 1658; Koch, R. 1684; Englisch, R. 1711] and is concerned primarily with the problem of finding the best resin to employ, does not mean that this patent is not anticipatory. It required no inventive talent to apply Greth's selected thermosetting composition upon surfaces which are prepared in the same manner as metal surfaces have been conventionally prepared in the past to obtain adherent coatings.

Thus plaintiff submits that any one of the prior art patents to Wilkey, Menking, or Greth, heretofore discussed, which show the use of thermosetting resins, is sufficient to negative invention, since each of these non-cited patents anticipates the "inventive step" of the method claimed in this case. This is particularly true of the Greth patent because of its clear disclosure and the admitted teaching of this essential step in such prior art patent.

POINT 3.

The Hall Patent in Suit Is Invalid for Lack of Invention Because the Method Claimed Is Merely an Assemblage of Old Steps, Which Produce No New, Surprising, or Unexpected Results.

Each of the steps of the Hall process, namely, surface irregularization, application of a thin coat of a thermosetting resin containing graphite, and baking thereof to set the resin, is old in the prior art as shown by the prior art patents discussed, *supra*. Indeed, defendant has admitted by its chart in evidence [DX-W] that each of the individual steps is shown in one or another of various prior art patents and publications.

Each of the old steps in the Hall patent in suit is effected for the same purpose and has the same result as it did in the prior art. Hall irregularizes the surface to obtain improved adherence. In the prior art the surface

roughening is for the same expressed purpose. See, for example, the Thomson patent discussed *supra* [R. 1616] or the aforementioned German art.

Hall uses a thermosetting resin as his vehicle and bakes it in to obtain a hard, wear-resistant film. In the prior art, as, for example, in Greth, Wilkey, Menking, and Bramberry, thermosetting resins as vehicles for the lubricating solids are employed for exactly the same reason. Moreover, the thickness of the film in the prior art is governed by the tolerances required, and, as specified in such prior art patents as Thomson, Wilkey, or Bramberry, is under one one thousandth of an inch.

When we combine these steps of the Hall patent, namely, the surface irregularization and application of a thin thermosetting resin coating containing lubricant solids therein, which is baked in, we obtain a film which is asserted to be hard, insoluble, and adherent (more permanent and wear-resistant). These are the particular advantages claimed for the Hall film. They result merely from the simple addition of the known advantages or results achieved by each of the individual steps. Surface irregularization was known to improve adherence. Use of a thermosetting resin was known to result in a harder film. No "additional or different function in the combination" results from the putting together of these steps as is required by the Supreme Court in *Great Atlantic & Pacific Tea Co. v. Supermarket Equipment Corp.,* 340 U. S. 147, 152, 95 L. Ed. 162, 167.

There was no factual evidence whatever offered by defendant to attempt to show that any of the steps of the Hall patent accomplish any different results than such steps did separately in the prior art. There was no evidence here that the bringing together of these steps produced any new or surprising consequences. The most that has been contended for by the defendant is that the

Hall patent, as a result of the bringing together of these steps, produced a coating which had good adherence and a relatively long wear life. Since the individual steps in the prior art were each designed to do the same thing in Hall's method which they did in the prior art, we suggest that what Hall did was not enough to sustain the validity of the patent for a mere combination of old steps.

As stated by this Court in *Hunter Douglas Corp. v. Lando Products, Inc.,* 215 F. 2d 372, at 375 (1954), in holding invalid the process claims there in suit.

> "The rolling operation in the Hunter invention is to thin the strip. That is true of all rolling operations. The shaver is designed to trim the edges. Likewise, that is true of all shavers. Passing the strips through a number of rolls was known. No new or different function is disclosed."

To the same effect see the following recent decisions by this Court involving method claims, each step of the method being old in the art: *Photochart v. Photo Patrol, Inc.,* 189 F. 2d 625 (1951); *Oriental Foods v. Chun King Sales,* 244 F. 2d 909 (1957).

The additional details of dependent claims 2 through 7 of the Hall patent add nothing new or inventive to the accumulation of steps. Both graphite and molybdenum disulphide, as specifically enumerated in claims 2 and 3, were used as lubricating solids prior to Hall. The use of molybdenum disulphide in lieu of graphite is shown in the Wilkey patent [R. 1661] and in the N.A.C.A. bulletin [R. 1711] prior to the 1950 application of Hall which first introduced this material into the Hall specification. It is recognized in this prior art as a superior lubricating solid to graphite.

Claims 4 and 5 specifying phosphatizing and sandblasting, respectively, as surface preparations to irregularize

the surface, are both admittedly old steps and have long been used to prepare metal surfaces for coating thereover [R. 168, 885-87, 1849]. While in its brief defendant asserts that other surface preparations are less effective [p. 37], such other methods preparatory to applying the coating, as set forth in the EverLube specifications [DX-B, R. 1851] and the Gilfillan specifications [DX-J, R. 1877], were nevertheless asserted by defendant to result in infringement.

The proportions of resin to solids set out in claim 6 are within the range specified in several prior art patents, as, for example, the Bramberry patents [R. 220, 1689]. And claim 7 covering the product produced by the process of claim 1 does not purport to add anything to the latter claim, by way of details old in the art or otherwise.

There is no evidence that any of these details of claims 2 through 6, each of which is old in the art, contribute anything new or achieve any different results from those obtained in the prior art when these same steps were there employed.

POINT 4.

All of the Steps of the Hall Patent in Suit Are Disclosed in the Bramberry Patents, Which Fully Anticipate the Claimed Method of Hall.

As pointed out under the discussion of the prior art Bramberry patents, each of the steps claimed in assembly by Hall is taught in Bramberry patents Nos. 2,470,136 and 2,534,406.

In these patents Bramberry irregularizes the surface by cross-hatched honing or chrome plating and by phosphate treating. He forms phosphate crystals at the surface of the metal by incorporating the phosphoric acid into his binder, thereby combining a phosphatizing step with the application step [R. 1689, 882].

Bramberry then applies to the prepared surface a binder containing graphite to form a coating which is under one one-thousandth of an inch thick, after baking at 400° to 600° F. to harden the binder [R. 1689].

Bramberry's binder is a resin of the type of petroleum or vegetable residue pitch which defendant argued does not include thermosetting resins. This contention is supported by the testimony of defendant's employee Mr. Crump, who was not a chemical but a mechanical engineer [R. 804]. Mr. Crump, who dismissed other prior art patents as showing no thermosetting resins because no baking step was disclosed, conveniently overlooked the baking of the Bramberry coating in his own discussion and tests of the Bramberry resin as set forth in his affidavit [PX-2-B, Appendix].

Certainly the weight of the evidence strongly supports plaintiff's contention that Bramberry teaches the use of both thermoplastic and thermosetting resins, as demonstrated in tests conducted by Dr. Dawe, Dr. Burnham, and Mr. DeDapper, all highly qualified chemists. Even the patentee applied the term "thermosetting" to Bramberry's pitch, thus showing that, in the sense in which the patentee used the term, the Bramberry disclosures embraced a teaching of both thermosetting and thermoplastic resins [R. 679].

Even if we should assume *arguendo* that Bramberry does not contemplate or clearly disclose thermosetting resins in his binder, there is no invention shown in Hall in the substitution of such thermosetting resins for the thermoplastic resins which Bramberry is asserted by defendant to teach.

The known properties of thermosetting resins are, by very definition, hardness and insolubility. These are the desirable properties asserted for the coating of the Hall patent. The substitution of one material with known

characteristics for another material does not rise to invention. See: *United States Appliance Corp. v. Beauty Shop S. Co.,* 121 F. 2d 149, 150 (C. C. A. 9, 1941) (Cert. denied 314 U. S. 680); *Krueger v. Whitehead,* 153 F. 2d 238, 239 (C. C. A. 9, 1946) (Cert. denied 322 U. S. 774); *Pierce v. Muehleisen,* 226 F. 2d 200, 204 (C. A. 9, 1955). Thus it would not require exercise of the inventive faculties to use a thermosetting resin, known to possess these characteristics of hardness and insolubility, in the known processes, such as taught by Bramberry, for the purpose of obtaining a hard insoluble film. As stated in *Pierce v. Muehleisen, supra* (p. 204):

> "We do no more than recite a well established rule of law when we say the application of an old process to analogous material of foreseeably similar character is not a sufficient contribution to the science to justify the award of a patent monopoly. It is only the achievement of the inventive faculty, as opposed to the product of the exercise of ordinary professional skill, that entitles the researcher to a patent . . ."

Finally, the evidence failed to establish any new or *improved* result in the Hall process over the application of a lubricating coating under the Bramberry disclosure. The tests of Mr. DeDapper and Dr. Dawe, both thoroughly explained and reported, showed that a substantially similar wear life is achieved with both the Hall and Bramberry coatings where the same lubricating solid is employed in each [PX-23, R. 1719; PX-43-B, R. 1239-48]. Defendant notably failed to test comparatively the two coatings for wear life, using graphite as the lubricating solid in each. Therefore, even the alleged improved results derived from the Hall coating over that of Bramberry is unsupported in the record.

POINT 5.

Finding of Fact No. 17 Is Erroneous.

The Trial Court's Finding of Fact No. 17, holding that the prior art patents do not anticipate the Hall patent in suit and that there is invention thereover, is clearly contrary to the weight of the evidence, as well as the clear showings of the listed patents themselves, which admittedly establish that each step of the Hall patent was old, including the particular step which was alleged to represent the inventive advance in the Hall patent. It is apparent that the Trial Court disregarded the admonition of this Court in reversing the Trial Court's holding of validity of the method patent involved in *Oriental Foods, Inc. v. Chun King Sales,* 244 F. 2d 909 (1957). In that decision this Court, quoting from the decision of the Supreme Court in the *Great Atlantic & Pacific Tea Company* case, *supra* (p. 912) stated:

> "'. . . Courts should scrutinize combination patent claims with a care proportioned to the difficulty and improbability of finding invention in an assembly of old elements. The function of a patent is to add to the sum of useful knowledge. Patents cannot be sustained when, on the contrary, their effect is to subtract from former resources freely available to skilled artisans. A patent for a combination which only unites old elements with no change in their respective functions, such as is presented here, obviously withdraws what already is known into the field of its monopoly and diminishes the resources available to skillful men. This patentee has added nothing to the total stock of knowledge, but has merely brought together segments of prior art and claims them in congregation as a monopoly. * * *.'"

Moreover, the Trial Court made no finding that the bringing together of the various old steps into the Hall process achieved any new, unusual, or even improved results. In the absence of such a finding, the validity of the Hall patent in suit over these prior art patents cannot, we submit, be sustained. See: *Kwikset Locks, Inc. v. Hillgren,* 210 F. 2d 483 (C. A. 9, 1954); *Bergman v. Aluminum Lock Shingle Corporation of America,* 251 F. 2d 801 (C. A. 9, 1957). As indicated in the last cited case (p. 809), "such a lack" in the findings "makes it *impossible*" to sustain the judgment of validity over the prior art patents cited.

Conclusion.

The Hall patent in suit is invalid for prior knowledge and use, prior public use, and prior invention under 35 U.S.C. 102(a), (b), and (g), and the Trial Court's findings thereon are amply supported by clear and convincing evidence and are not clearly erroneous. Therefore the Court's judgment of invalidity on these grounds, and each of them, should be affirmed.

The Hall patent in suit is also invalid for anticipation and lack of invention over the prior art patents and publications pleaded, and the judgment of invalidity should be affirmed on these grounds, as well as on the prior knowledge and use, public use, and prior invention found by the Trial Court.

Respectfully submitted,

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Attorneys for Appellees.

APPENDIX.

1. Summary of the History of the Art of Dry Film Lubrication as Provided by Dr. John Burnham [R. 178-182].

"Q. (By Mr. Kern): Now, Dr. Burnham, I believe that you indicated that you made a thorough study of the art of dry film lubrication, engineering, and in the libraries out here, and in the New York library I think you stated. I wonder if before we go into individual patents whether you would give us a brief general history of the art of dry film lubrication?

"A. Well, the art of solid lubricant films is quite old, but I will give a history of the art as I have found it in the patents and technical literature, and try to be brief in that respect.

"This art shows up as a history of the search for a binder of composition materials that can be used to bind solid lubricants on surfaces, that is, on surfaces which are to be used for—which are going to slide in their operation relative to one another, and, therefore, lubrication is required on bearings.

"This art has been affected by the advance in several associated arts, such as the art of solid lubricants, that is, the art itself of different solid lubricants, the art of varnishes and paints and protective coatings for metals, and the art or the treatment of surfaces of these metals in order to improve the adherence of coatings generally on the surfaces.

"The art of solid lubricants, of course, begins with the use of graphite, which is very old, and which has been known for centuries, but at first the graphite was merely sprinkled on the metal surface for the purpose of using it as a lubricant, but it was found unsatisfactory, because as the parts engaged in friction the graphite would slough off the surface.

"The Court: You can still use it on iron hinges, can't you?

"The Witness: Yes, sir.

"The Court: All right. And on steel windows. I know, because I have done it down in Palm Springs.

"The Witness: I also do it. However, the art of solid film lubricants really began with the idea that one could take the graphite and bind it on the surface, that is, use a binder to form the film, which is more or less permanent, or which is relatively permanent on the surface, and thus avoid this difficulty.

"Now, this idea first occurred to Hickie in England, who got the basic patent in England in 1895, Patent 11,949, in which he shows, or his invention consists of incorporating plumago with a gum binder, and applying the mixture to the surface of a metal for purposes of lubricating it.

"This represents the first use of a resin, a gum in this case, as a natural resin to bind the graphite to the metal surface for this purpose.

"The second step in this history of the solid film lubricant was the patent to Bergl in Germany in the early 1920's. Prior to this a composition of phenol formaldehyde and graphite had been made by Baekeland, who invented the phenol formaldehyde resins we are talking about, in which he incorporated the graphite to make a lubricating composition, but he did not apply it in a film form. He merely observed that a bearing could be made which needed no outside lubrication to be added by putting the graphite in this thermosetting uncured resin, and curing it, and forming a solid bearing.

"The next use, however, of a definite solid film as a lubricant came in the invention of Bergl, who showed that one might take all the varnishes and vehicles used in the way of the varnish industry and the paint industry and

protective coatings for metal, and incorporate therein graphite and apply this mixture to a surface and convert it to a solid infusible film, or let us say a solid film which would at least hold the graphite on the surface.

"Next in line, Greth of Germany, also of Germany, recognized, or, let's say invented and produced a particular type of thermosetting resin binder to prepare such a lubricant film, and he taught in effect that a specific thermosetting resin was useful in applying or binding graphite to the surface of a metal.

"Following Greth we have a development in solid lubricants, or, at least following that time, in which molybdenum sulfide, or moly sulfide, as we called it, was discovered to have superior solid lubricant properties over those of graphite, and Wilkey was the first to use this material, to incorporate this solid film, that is, this solid lubricant molybdenum sulfide with a thermosetting resin to produce an adhering solid film for purposes of lubrication.

"Along with these developments in the solid lubricants, there were developments in the types of synthetic varnishes or synthetic resins which could be used, such as the alkyd resins, which could also be used for the purpose of applying the solid lubricant particles to surfaces, and these were originally, of course, developed for varnishes and protective coatings which were applicable directly in solid lubricant films.

"The last art, which I haven't discussed, is the development in the treatment of surfaces of metal to improve adherence of coatings and paints, and which also helped, of course, to adhere coatings designed for lubricating purposes, and these include the electrolytic etching of aluminum, for example, the electrolytic oxidation of aluminum, the phosphate coatings on iron and other ferrous metals, to improve the adherence of coatings and to cut down corrosion.

"And then there is one other associated field, in which these resin binders we are talking about were actually used in conjunction with graphite for the purpose of preparing a film which would adhere, but which was not necessarily used for lubricating purposes, but in fact was used as a resistant film, because when you introduce graphite into such a coating, it also changes its electrical conductivity, and this was used in that field." [R. 178-82.]

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2. File Wrapper Affidavit of Ralph E. Crump [PX-2-B, pp. 38-51].

In the United States Patent Office

Div. 25

Applicant:	Ralph D. Hall
Ser. No.:	425,751
Filed:	April 21, 1954
For:	Dry Lubrication Process and Product

State of California, County of Los Angeles—ss.

Affidavit

Ralph E. Crump, being first duly sworn, deposes and says:

I am the Chief Engineer of Electrofilm, Inc., assignee of the above entitled Ralph Hall application. I am a graduate of the University of California at Los Angeles, with the degree of Bachelor of Science. I have been employed as an engineer by Electrofilm, Inc. continuously since 1950, and am thoroughly familiar with the solid film lubricant manufactured by Electrofilm, Inc. and with the above entitled Hall application covering that lubricant.

I was present at two recent personal interviews with the Examiners of said Hall application, at which interviews we discussed in considerable detail the nature, man-

ner of formation, advantages, and extensive commercial success of the Hall solid film lubricant. This affidavit is being filed pursuant to an understanding reached at the second of the interviews, as proof of certain facts which the Primary Examiner considered necessary to a showing of invention, and more particularly to prove facts indicative of both the superiority and unobviousness of the Hall lubricant as compared with the prior art disclosures.

The lubricant covered by said Hall application comprises a thin lubricating film which uniformly coats a bearing surface or the like, and is cured to a solid, dry form on that surface. This film will serve, by itself, as the sole lubricant for many types of moving parts, such as bushings, screws, hinge pins, guides, and the like, and is in most instances a permanent lubricant capable of serving its lubricating function for the entire life of the part treated.

To afford a background for the facts to be evidenced by this affidavit, I will briefly describe the essential characteristics of the process by which the Hall films are formed.

The first step in this process is to roughen the surface of the element to be coated, usually by sand blasting or by a phosphatizing treatment, to produce a large number of small irregularities on the surface. Next, a free flowing coating is applied uniformly to the irregularized surface to form a thin film on the surface. This mixture includes a binder which is at least in part a *thermosetting* resin, with a multitude of minute solid lubricant particles being distributed throughout the binder. After application of the coating substance, the thermosetting binder is cured in place, to tightly bond the film to the irregularized surface, and to permanently retain the lubricant particles in proper positions within the film. For best results, the film thus formed should be very thin, preferably less

than 1/1000th of an inch in thickness. Where films of greater thickness are employed, the upper portion of the film often tends to sheer off or break away from the lower portion, and also the increased film thickness may occupy too much space on parts having a small running clearance.

In a film formed in accordance with this Hall process, the solid lubricant particles give to the film an extremely effective lubricating quality. This lubricating quality is for most practical purposes entirely permanent, lasting usually for the life of the part, largely because the thermosetting resin adheres tenaciously and permanently to both the irregularized surface and the lubricant particles, to permanently retain the particles on the surface. Since the thermosetting resin is permanently cured, it can not subsequently soften or melt in use, and thereby release the lubricant particles, as could a thermoplastic resin.

Solid film lubrication was virtually unknown to the industry until 1946, when Ralph Hall made the invention represented by the above entitled patent application (original Hall filing date April 13, 1946). Since then, solid film lubricants applied in accordance with the Hall process have come into very wide scale commercial use for a variety of lubricating purposes. During the twelve month period from September 1, 1953 to August 31, 1954, Electrofilm, Inc. made direct gross sales of solid film lubrication covered by said Hall application in the amount of $375,087.00 and an additional approximately $650,000.00 worth of the lubrication was applied by job shops and manufacturers licensed by Electrofilm. These figures are brought out in a paper attached to this affidavit, titled "Commercial Use of Hall Lubricant Film", and hereby made a part of this affidavit. The same paper also lists by name some of the numerous well known manufacturers who utilize the Hall lubricant film, and gives examples of certain of the parts on which the film is used.

Bramberry Patent No. 2,534,406.

At the recent interviews, Examiners relied heavily on Bramberry Patent No. 2,534,406, issued Dec. 19, 1950 (application filed September 22, 1944) as the closest prior art against the Hall application. I have read this Bramberry patent very carefully, and have carefully considered its disclosure as it bears on the Hall application. From this review, and from actual experiments which have been conducted under my supervision with the Bramberry and Hall films, it is entirely clear to me that the Bramberry film could not possibly serve as a lubricant with enough permanency to be sold commercially for the uses for which the Hall film is intended. This is due largely to the fact that Bramberry employs a thermoplastic resin as a binder, ("petroleum or vegetable residue pitches", see col. 5, line 59) rather than a thermosetting resin. Bramberry specifically states that his resin should have a softening point between 155° and 170° F. (see Col. 5, line 71) and was thus obviously thinking only of thermoplastic resins for binders in his film. Due to the absence of a thermosetting resin in Bramberry, the resulting film is relatively soft and easily destructible, and will melt and release the lubricant particles under elevated operating temperatures. Consequently, the Bramberry film is not in any sense the permanent type of film produced by the Hall process. In fact, it is apparent from the patent itself that Bramberry intended his film for a very temporary use, specifically to serve as a cylinder lubricant in an internal combustion engine during the initial 'run-in' period.

Comparative Tests: Hall v. Bramberry

To compare the performance of films applied according to the Bramberry patent with films applied by the Hall process, I have conducted tests on a modified MacMillan wear tester of the type commonly used for this

purpose in the industry. In this device, a standard Timken test cup is rotated under load at 72 r.p.m. with one face of the cup in frictional contact with a steel shoe. By means of weights and a fulcrum, the contact pressure between the shoe and the rotating cup face is built up in increments of 2000 p.s.i. added each minute until a total of 40,000 p.s.i. is applied. This testing process is described more specifically in the attached Technical Bulletin #4002 of Electrofilm, Inc., entitled "Testing Electrofilm Dry Film Lubricant for Wear".

Four Timken test cups were roughened and then coated in accordance with the Bramberry teaching. Two of these cups were first coated with the 'trowelling compound' of Bramberry, and then his 'spraying compound', while the other two were coated with only the 'spraying compound' Both compounds were formulated strictly in accordance with the examples given in column 5 of the Bramberry patent, as follows:

Trowelling Compound

a) 20 grams of Dixon Crucible Graphite #200-10.

b) 40 grams Tricresyl Phosphate—commercial grade (above ingredients were mixed thoroughly with air-driven propeller mixer).

Spraying Compound

a) Dissolved 77.8 grams of binder (asphalt-Douglas Oil Company of California's Type 1 Asphalt Roofing 156° F.—M.P.) in 77.8 grams commercial Xylol, solvent grade.

b) Dispersed 177.5 grams Dixon Crucible Graphite #200-10 in 177.5 grams Xylol and added to (a) above.

c) Added 123.5 grams of concentrated commercial phosphoric acid and 19.7 grams Alrose "Amine—0" to 203 grams of water (tap), and shook well.

d) Mixed (b) and (c) above, together, and shook one-half hour on standard paint shaker (Red Devil).

e) Thinned (d) above with Xylol, to spray consistency.

f) Sprayed onto the four cups to thicknesses of .6 mils, .35 mils, .4 mils and .6 mils respectively.

The two cups coated with both the 'trowelling compound' and the 'spraying compound' ran only *2 hours, 41 minutes* and *5 hours, 5 minutes* respectively, and their films then became completely ineffective as lubricants. The other two cups, on which only the 'spraying compound' was employed, ran *9 hours, 58 minutes* and *2 hours, 34 minutes* respectively, and the films then broke down. All of these times are entirely too short to allow acceptance of the films for the type of commercial use for which the Hall film is intended, the absolute minimum running period for such uses being 20 hours, and a period of at least 60 hours being preferable.

Three additional test cups were then prepared in accordance with the Hall process, as follows:

a) Surface of cup was irregularized by phosphate bath treatment (Parker Lubrite Treatment).

b) The irregularized surface was then coated with the following compound:

53.0 pounds *thermosetting phenolic resin,* modified with small percentage of Polyvinyl Butyral (approx. 10% to 30%) and a small percentage of an elastomeric resin (approx. 2% to 5%)—21% solids content in the 53.0 pounds of resin.

20.0 pounds solvent (approx. equal volumes of Dioxane, Ethylene Dichloride, Ethenol, Secondary Butanol, and Methyl Ethyl Ketone).

1.4 pounds Dixon Graphite #200-10.

12.2 pounds Molybdenum Disulphide (climax #2) (above mixture further thinned to spraying consistency by Dioxane).

c) The coating was then baked for 1 hour, 10 minutes at 375° F., with the ultimate film thicknesses on the three cups being .45 mils, .45 mils, and .40 mils.

These cups, prepared in accordance with the Hall process, were placed in the Mac Millan wear tester, with all conditions the same as when the Bramberry cups were tested. The three Hall cups ran for 131 hours, 117 hours, and 125 hours respectively, before the films showed signs of breaking down, thus indicating the very definite superiority of the Hall films over the Bramberry films.

At the recent interviews, Examiners were shown, and personally examined, the above discussed test cups treated by the Bramberry and Hall processes.

It will be recalled by Examiners that even after having run for 120-130 hours, the Hall films were in much better condition than the Bramberry films, which had become completely useless after 2-10 hours.

The Literature Survey

The primary Examiner has raised a question as to whether the substitution of a thermosetting resin in Bramberry for the thermoplastic resin actually employed would be a change amounting to invention. On this point, it is highly significant that the teachings of the art prior to the original Hall filing date in 1946 were all definitely in the direction of utilizing thermoplastic rather than thermosetting resins in solid film lubricants. In view of the teachings, it would certainly not have occurred to an ordinary person skilled in the art that a thermosetting resin might actually be preferable over a thermoplastic resin in a solid film lubricant, and consequently the use of such a resin by Hall amounted to an inventive advance over Bramberry. Thermoplastic resins were naturally supposed to be better lubricants by reason of their relative softness, deformability, and other char-

acteristics usually associated with lubricants. Thermosetting resins, on the other hand, are hard and tend to be brittle, and would not be suspected to be capable of serving any useful function in a lubricating film.

Examiner has asked that an affidavit be presented on the above point, presenting authorities which would indicate preference in the art for thermoplastic resins in lubricant films prior to the earliest Hall filing date. Consequently, since the interviews, I have made a careful search of all patents and literature to which I have access on solid film lubricants, including the entire literature file of Electrofilm, Inc. on the subject. This Electrofilm file has been accumulated over a period of several years, and is, I believe, one of the most complete literature files in the country on solid film lubricants.

In this entire field of search, I have found no mention prior to the original 1946 Hall filing date of a solid film lubricant of the present general type, in which there was employed a *thermosetting* resin cured in place on the surface to be lubricated. There were, however, several pre-1946 disclosures (all patents) of solid film lubricants employing *thermoplastic* resins as binders. These early patents using thermoplastic resins are discussed briefly below:

Patent No. 1,581,394, E. G. Dann, April 20, 1926, Application filed January 11, 1918.

This Dann patent discloses a lubricant film consisting of graphite particles contained within a binder. The particular binder referred to by the patentee is "a coal tar product known to the trade as 'mineral black' *which becomes fluid when heated*". Obviously this binder "which becomes fluid when heated" is thermoplastic, rather than thermosetting.

Patent No. 1,583,913, Joseph Brincil, May 11, 1926, Application filed October 16, 1924.

This patent contemplates a lubricant film comprising a mixture of graphite and a binder of shellac, which is a thermoplastic resin.

Patent No. 1,603,086, Percil Charles McKee, October 12, 1926, Application filed May 9, 1925.

This McKee patent incorporates graphite and other materials within a binder which is formed from the unwashed celluloid of scrap picture film. The celluloid and gelatin of the picture film are of course thermoplastic, and cannot permanently bond the graphite particles in place on a bearing surface in the manner of Ralph Hall's thermosetting resin.

Patent No. 1,686,951, Joseph Brincil, October 9, 1928, Application filed September 21, 1926.

This second Brincil patent is similar to the first, discussed above, and mentions only shellac as a particular type of binder which may be employed.

Patent No. 2,335,958, Arthur L. Parker, December 7, 1943, Application filed March 31, 1941.

In the formula given in this patent for a lubricating film, the only binder employed is a "polymerized vinyl resin". Though Parker does refer to a "powdered thermo-set resin" in his formula, this thermo-set resin is obviously utilized only as a filler, and does not adhere in the manner of a binder to either the graphite particles or the surface being treated. This is true because the phrase "thermo-set resin" refers to a resin which has already been cured or set prior to its incorporation into the coating compound. The "thermo-set resin" is therefore not cured in place on the surface of the bearing element or other part being treated, as is necessary in

order to attain the advantage realized from the use of a thermosetting resin in the Hall process. In this connection, attention is directed to the following statement on page 1, column 2, line 5 of Parker "The thermo-set resin is employed in a finely powdered form, produced by grinding the condensed and *set* resin in a ball mill or the like until it is of fine uniform size and angular shape, . . . ".

Patent No. 2,470,136, Harry M. Bramberry, May 17, 1949, Application filed September 22, 1944.

This Bramberry patent utilizes as a binder a resin which "may be of the class of petroleum or vegetable residue pitches". Such "pitches" are obviously thermoplastic in character rather than thermosetting as is clearly indicated by the fact that Bramberry refers to the binder as having a softening point between 155° and 170° F.

Patent No. 2,534,406, Harry M. Bramberry, December 19, 1950, Application filed September 22, 1944.

This second Bramberry patent, which has been discussed in some detail above, also utilizes as a preferred binder a resin from the class of petroleum or vegetable residue pitches. This second Bramberry patent also states that the binder preferably has a softening point between 155° and 170° F.

In my literature survey, I was unable to find any articles, books, or other non-patent literature which discussed solid film lubricants prior to the 1946 Hall filing date, regardless of what type of resinous binder might be employed. This lack of early non-patent literature of course bears out my previous statement that prior to the development of the Hall process, there was no substantial commercial use of solid film lubricants (and consequently no discussion in the literature of such lubricants).

The Siebel Reference

Examiner has called our attention to an additional reference, specifically patent number 2,330,635, Siebel, September 28, 1943. I have reviewed that patent carefully, and am able to state unequivocally that the Siebel film could not possibly serve the lubricating function for which the Hall film is intended. Indeed the Siebel film is purposely designed to serve as an abrasive, rather than a lubricant, and for that purpose contains large quantities of abrasive particles, such as a grinding powder (see page 2, column 1, line 57 of Siebel). The matter of choosing a binder for such an abrasive film obviously entails vastly different considerations than the choice of a binder for a lubricant film, and consequently the use of a thermosetting resin in Siebel would not suggest the use of such a resin in Hall's lubricant film.

RALPH E. CRUMP
Ralph E. Crump

Sworn to and subscribed before me this 10th day of November, 1954.

[Seal]

ODETTE B. JOYCE
Notary Public in and for State of Calif., County of Los Angeles.
My Commission Expires August 31, 1958.